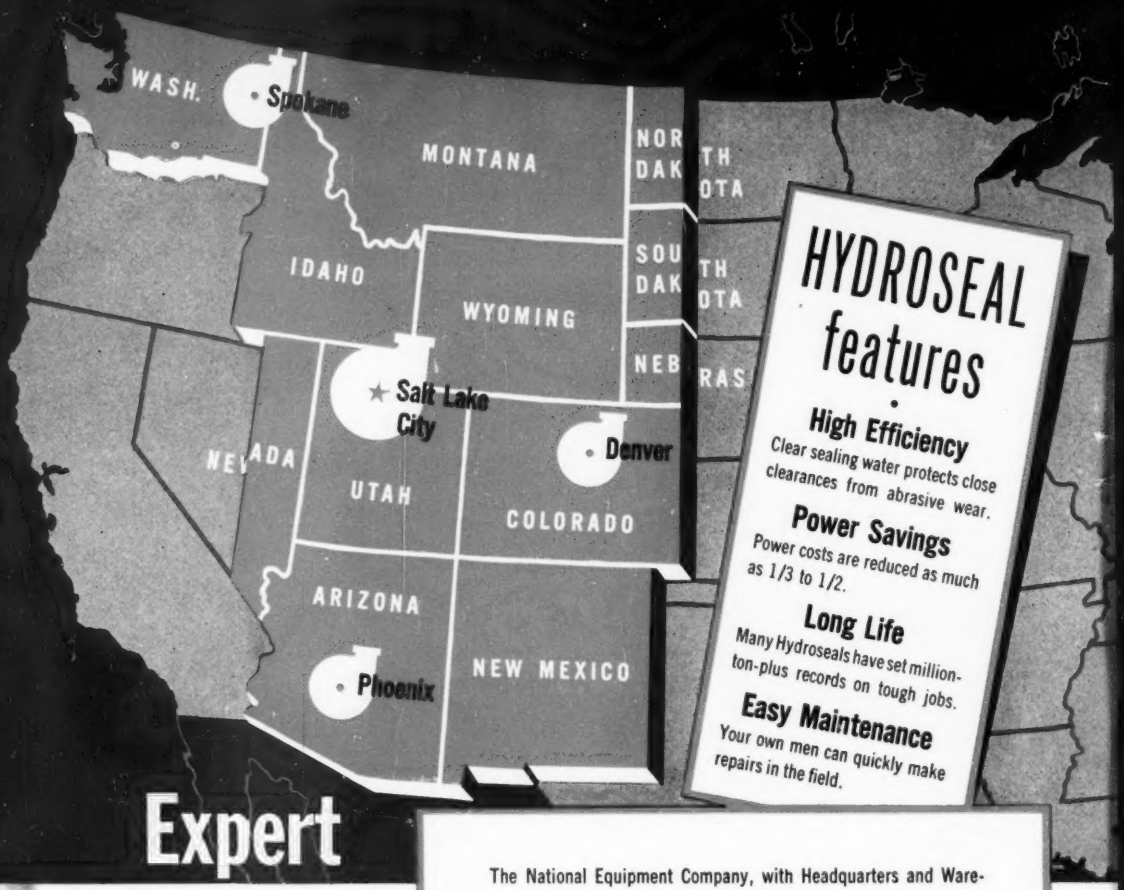
ENGINEERING AND MINING JOURNAL

FEBRUARY 1952

MINING'S MAN OF THE YEAR
DMPA'S HOWARD I. YOUNG

83rd ANNUAL SURVEY AND OUTLOOK NUMBER



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High Efficiency
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Power costs are reduced as much as 1/3 to 1/2.

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Many Hydroseals have set million-ton-plus records on tough jobs.

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Your own men can quickly make repairs in the field.

Expert abrasives-pumping service

The National Equipment Company, with Headquarters and Warehouse in Salt Lake City and with branches in Phoenix, Spokane and Denver, has served the mining industry in the Rocky Mountain area for over 30 years.

They are specialists in the application of HYDROSEAL Pumps.

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MAXIMIX RUBBER PROTECTED

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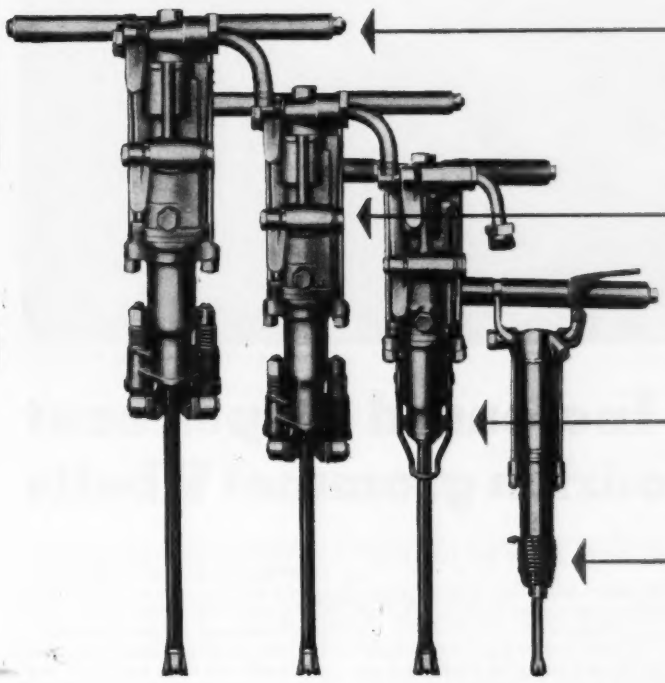
For Maximum Production

Match the JACKHAMER to the JOB!

This complete I-R line offers you a rugged, powerful Jackhamer for each type of service

Today's need for higher and higher production, with limited manpower, makes the *efficiency* of your rock drilling equipment more important than ever before. You get more footage per man hour—with minimum effort and fatigue—when you use an Ingersoll-Rand Jackhamer of the correct weight and power for the work to be done.



J-50 This heavy-duty, 60-lb. Jackhamer is best suited for drilling vertical holes up to 20 feet deep—in shaft sinking, excavation, road building and quarry work. It also makes an excellent light-weight drifter when used with Carset Jackbits.

J-40 This powerful, 50-lb. Jackhamer readily handles heavy-duty jobs in mines, excavation, trench and road work where the drill must be lifted or carried frequently. The J-40 with the JL4 Jackleg and Carset Jackbit combination is ideal for stope drilling in mines.

J-30 This rugged, 35-lb. Jackhamer is ideally suited for horizontal or semi-horizontal drilling in mines, quarries, construction jobs and industrial plants.

J-10 This 14-lb. Utility Jackhamer, complete with automatic rotation and hole blowing has many applications for light-duty drilling and can also be used with Carset steels, chisels, gouges, moil points and star drills.

CARSET JACKBITS All Jackhamers drill greater footage per man hour when Carset Jackbits are used. These I-R super-bits, tipped with tungsten carbide, outlast steel bit usages by as much as 400 to 1 — have negligible gauge wear — practically eliminate bit changes — maintain uniformly high drilling speed for the full depth of the hole.

635-5

FOR COMPLETE INFORMATION on all of these Ingersoll-Rand Jackhamers, write for your free copy of Catalog No. 4096.

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RESEARCH KEEPS **B.F.Goodrich** FIRST IN RUBBER

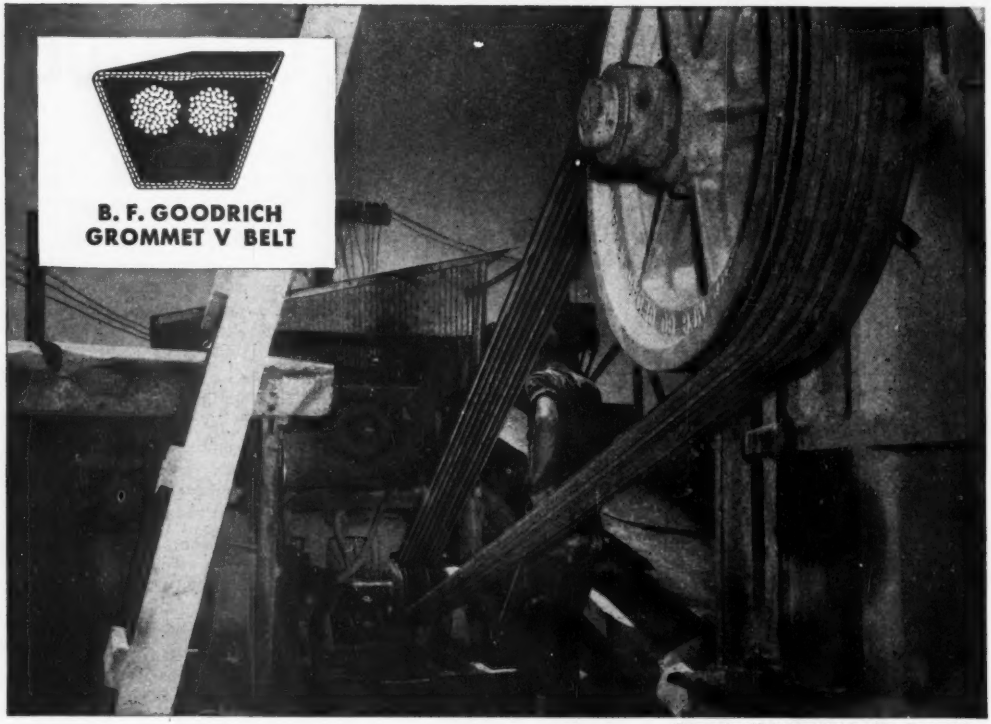

Photo courtesy of Valley Limestone & Gravel, Inc., Farmington, Iowa

Production increased 25 per cent with B. F. Goodrich grommet V belts

B. F. Goodrich often cuts belt costs 20 to 50 per cent

THESE belts drive a rock crusher 9 hours a day, six days a week. In addition to the long hours belts are exposed to dampness, oil and sharp grit. Still worse, the crusher abuses the drive with every impact of its jolting, grinding action. Previously, the operators had "tried everything" including flat belts, other V belts, even a chain drive. But mechanical trouble and production hold-ups continued.

The B. F. Goodrich grommet belts were tried at the suggestion of a BFG distributor's salesman. When the picture above was taken the grommet belts had been in operation almost 2 years. The grommet belts' record: production up 25%, large savings in labor and maintenance time, no belt replacement costs, better working conditions for men—less noise, greater safety. BFG grommet belts can be counted on to *save* because of:

No cord ends—A grommet is endless, made by winding heavy cord on itself to form an endless loop. It has no overlapping ends. Because most of the failures in ordinary V belts occur in the region where cords overlap, the endless cord section in a grommet V belt eliminates such failures.

Concentrated cord strength—All of the cord material in a B. F. Goodrich grommet multiple-V belt is *concentrated* in twin grommets, positioned close to the driving faces of the pulley. No layers of cords to rub against one other and generate heat; cord and adhesion failures are reduced.

Better grip, less slip—Because a grommet is endless, a grommet V belt is more flexible, grips the pulleys better. Size for size, grommet multiple-V belts will give ⅓ more gripping power, pull heavier loads with a higher safety factor.

Only B. F. Goodrich has the grommet!—No other multiple-V belt is a grommet V belt (U.S. Patent No. 2,233,294). Now available in C, D and E sections. See your local B. F. Goodrich distributor. *The B. F. Goodrich Company, Industrial & General Products Division, Akron, Ohio.*

Grommet V Belts BY
B.F.Goodrich
RUBBER FOR INDUSTRY

ENGINEERING AND MINING JOURNAL

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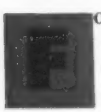
. . . when mine car wheels are lubricated with TEXACO OLYMPIAN GREASE



OR easier, power-saving starts—in cold weather as in hot—there's nothing like *Texaco Olympian Grease* in your mine car wheels. And that goes whether bearings are plain, cavity hub or anti-friction.

Texaco Olympian Grease gives longer lasting protection against wear because it *stays in* the bearings . . . seals out dirt and moisture . . . resists oxidation . . . will not separate in use or in storage. You'll get longer bearing life with *Texaco Olympian Grease* and maintenance costs will come down. There are three consistencies to meet every requirement—all easy to apply.

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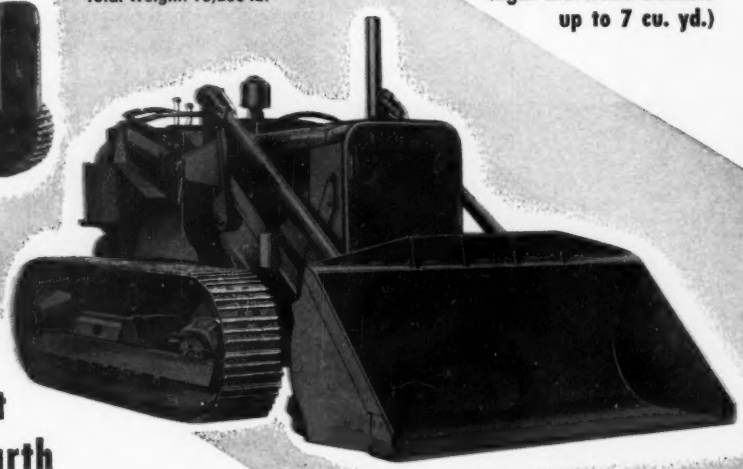
for Fifty Years

NOW . . . . . Front-End of New ALLIS-

1-Yd. HD-5G
Drawbar hp.: 40.26
Dumping height*: 9 ft. ¼ in.
Total Weight: 16,200 lb.

Standard Buckets up to 4 cu. yd.
(light materials buckets up to 7 cu. yd.)



The Newest, Finest Tractor Line on Earth

The new Allis-Chalmers tractors are not just refinements of existing models . . . *they are new from the ground up* . . . without compromise anywhere in design or materials. Back of their design are your own ideas and those of your operators and mechanics. These are combined with the vast experience of Allis-Chalmers to set new standards of Performance, Durability, Simplified Servicing, Ease of Operation.

2-Yd. HD-9G
Drawbar hp.: 70
Dumping Height*: 11 ft. 4½ in.
Total Weight: 29,800 lb.

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Originator of the Torque Converter Tractor

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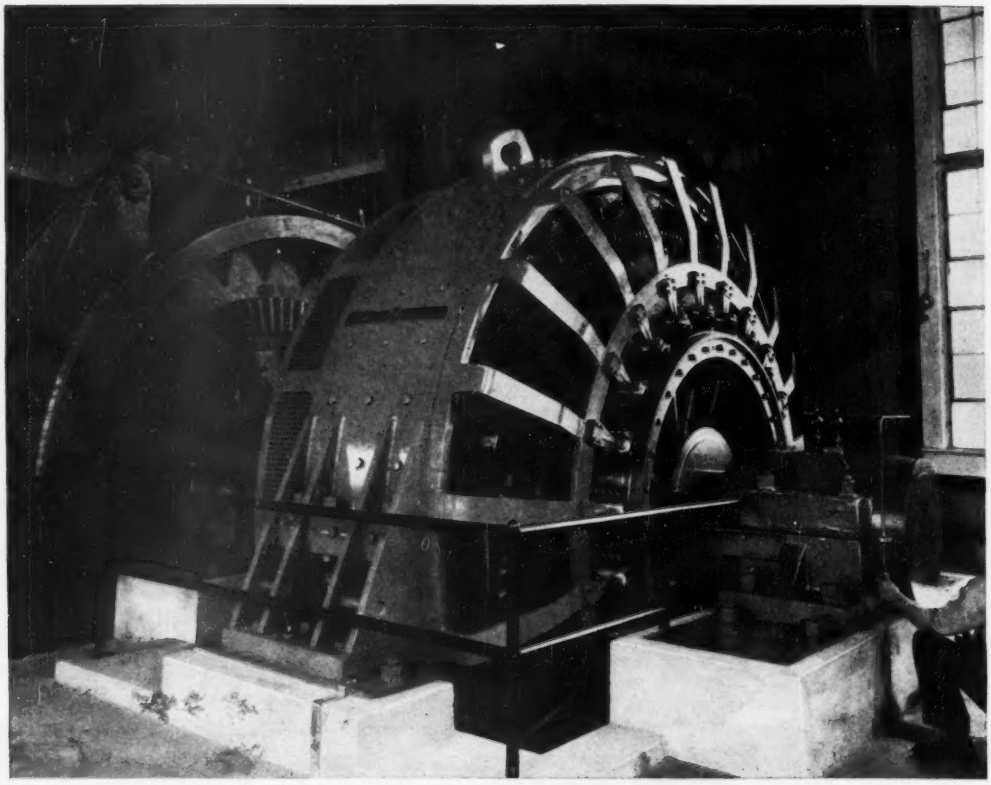
3-Yd. HD-15G
Drawbar hp.: 102
Dumping Height*: 12 ft. 8 in.
Total Weight: 40,000 lb.

4-Yd. HD-20G
Hydraulic Torque Converter Drive — 175 net engine hp.
Dumping Height*: 13 ft. 5 in.
Total Weight: 61,600 lb.

Height of bucket hinge

ANACONDA installs one of world's largest hoist motors

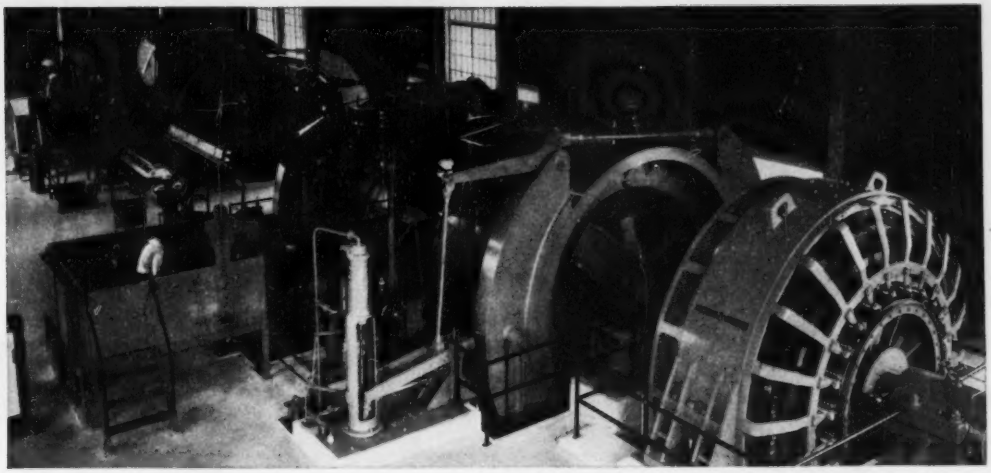
—for high-tonnage low-cost output!



Here it is installed—the G-E 3000-hp 600-volt 60-rpm d-c motor that will drive Anaconda's Kelley Shaft ore hoist. Scheduled to go into production in 1952, it will permit handling much larger tonnages than possible now. Skips, carrying 12 tons of ore per trip, will have a capacity of 853 tons per hour from 868 feet, with approximate power consumption of only 12.4 kwh per trip. From a 4335 foot depth, capacity will be 307 tons per hour, using about 57.3 kwh per trip. New hoist is expected to be able to handle approximately 10,000 tons of low-grade ore per day.

GENERAL ELECTRIC

660-21

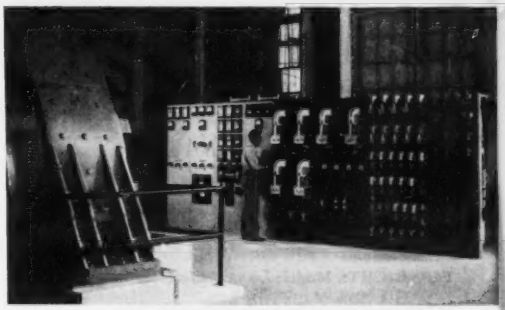


This over-all view shows the G-E 3000-hp motor direct-connected to the hoist's two drums, with the hoist operator at his control station. Expected capacity of the new hoist is 10,000 tons per day, supplemented by the 5000-tons-per-day capacity of the other hoist shown in background.

Complete G-E hoist-drive equipment for Kelley Shaft in Greater Butte Project includes 3000-hp d-c motor, permits lifting 12 tons of ore per trip at low kwh cost

High-tonnage low-cost hoisting is a "must" with Anaconda. Especially so on its Greater Butte Project for the long-range economical mining of an anticipated 130,000,000 tons of low-grade ore by block caving. That's why Anaconda, a satisfied customer since 1913, asked General Electric to supply the main ore-hoist drive in its Kelley shaft —including one of the largest single mine-hoist motors in the world!

General Electric's extensive experience covers over 900 large hoist-drive installations now serving the country's mines, helps explain why companies like Anaconda keep coming back for more of the same. When *you* call in a G-E mining-industry specialist, you put this experience to work for you —profitably. Meanwhile, send for Bulletin GET-1430, "Electric Equipment for Mine Hoists." *General Electric Company, Schenectady 5, N. Y.*

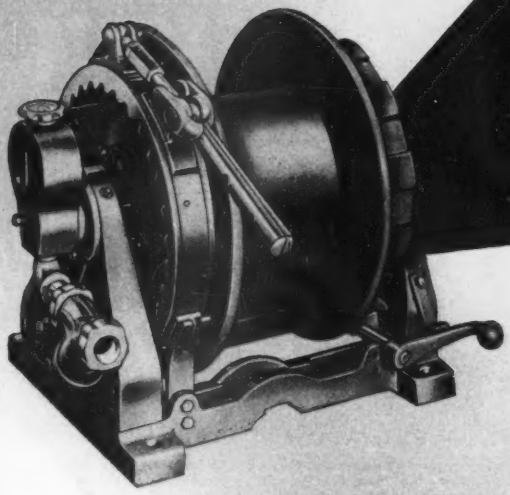


Control for the huge G-E motor is centered in this panel, built throughout to meet specifications laid down by Anaconda. Designed for either manual or automatic hoisting, the drive will operate two skips in balance, at a speed of 2250 feet—almost half a mile—per minute.

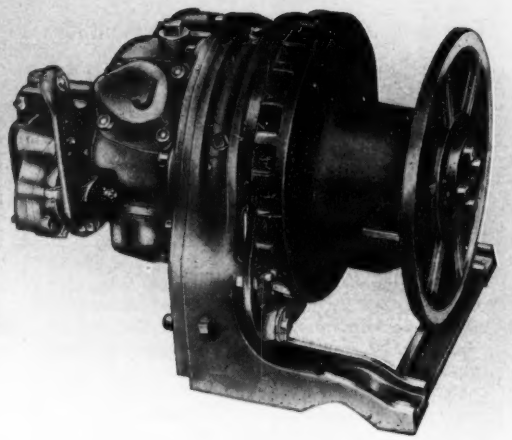
New G-E Motor Selection and Application Course can help train your mine and mill workers, increase their efficiency. A G-E "More Power to America" program, it shows how motors work, types in use, and how to select and apply them. Write now for Bulletin GEA-4938-16 describing the course in detail.

MINE-HOIST DRIVES

In addition to hoist motor and control panel, the G-E drive equipment includes this motor-generator set to supply the needed d-c power. It comprises a 2500-kw 600-volt d-c generator driven by a 3500-hp 514-rpm 2400-volt synchronous motor, and a 60-kw exciter.



JOY



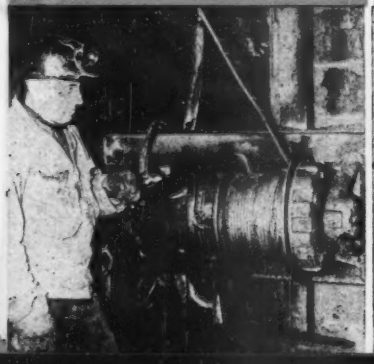
TOP: Model F-113 "Turbinair". Compact, simple design with motor *inside* the drum. Direct power transmission from motor to drum assures maximum efficiency. Simple, accessible controls make operation easy.

RIGHT: Model DW-111 "Pistonair". Features reversible power with light weight. Four-cylinder, 3½ h.p., reversible motor will handle up to 1200 lbs.

FAR RIGHT: Model L-111 "Pistonair". For heavy hoisting jobs. 7½ h.p., reversible, five-cylinder motor for loads up to 2000 lbs.

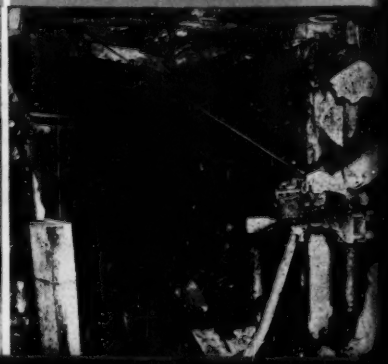
OVER 100 YEARS OF ENGINEERING LEADERSHIP

Joy L-111 reversible "Pistonair" Single Drum Hoist operating in a magnetite iron mine in the Adirondack region of New York.

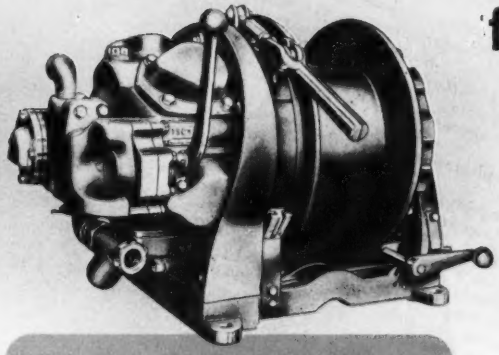


Joy F-112 "Turbinair" lifting timbers in a raise in a western mine. The extra rope capacity of the F-112 (430' of ⅜" rope) makes it applicable to any of the utility hoisting needs in this mine.

Joy AW-80 Air Winch hoisting timbers into place in a drift in a Canadian mine. At a weight of only 85 lbs., this unit will lift 800 lbs!



SINGLE DRUM HOISTS



They're real Mining Hoists—designed and built from long field experience expressly for underground use

Joy Single Drum Mining Hoists are compactly designed, of modern, high-strength alloy metals, for lighter weight with greater power and efficiency.

The complete Joy line includes the "Turbinair" series which develop maximum horsepower per unit of weight; the "Pistonair" with reversible four or five cylinder motors; and compact, rugged electric-powered models which feature space-saving short-length external motors.

Joy Single Drum Hoists are built with lifting capacities ranging from 500 to 3500 lbs., and rope capacities from 150 to 1500 ft. "Pistonair" models have a positive acting safety brake which holds the load in any position when the throttle valve is "off."

Joy also manufactures a complete line of Shaft Hoists, and Two- and Three-Drum Slusher Hoists in capacities to handle all hoisting and scraping needs.

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Affiliate: The Farval Corporation, Centralized Systems of Lubrication. In Canada: Peacock Brothers Limited.

Another

IRON MINING OPERATION *uses* NORTHWESTS

Two of the Northwests in the mines of the J. R. Simplot Iron Mines, Inc., near Palisades, Nevada, loading out iron ore for Japan.

- **SHOVELS**
- **CRANES**
- **DRAGLINES**
- **PULLSHOVELS**
- **TRUCK CRANES**

THE J. R. Simplot Iron Mines, Inc., on its iron mining operations near Palisades, Nevada, is using real Rock Shovels — Northwest Shovels. These machines are taking out iron ore for shipment to Japan via Oakland, Calif.

The J. R. Simplot organization has been a Northwest user for many years and has purchased nine Northwest machines. The fact that an outfit like this that can own any make of equipment they want, yet purchase Northwests again and again, should be significant to anyone making plans for the future. Northwest owners in mining operations find that the faster swing and faster action generally mean greater output. Northwest steering means easier maneuvering on mine floors and benches and Northwest dependability, design and construction means less "down" time on far away mining operations.

You can plan for a Northwest. Why not talk it over with a Northwest man?

NORTHWEST ENGINEERING COMPANY

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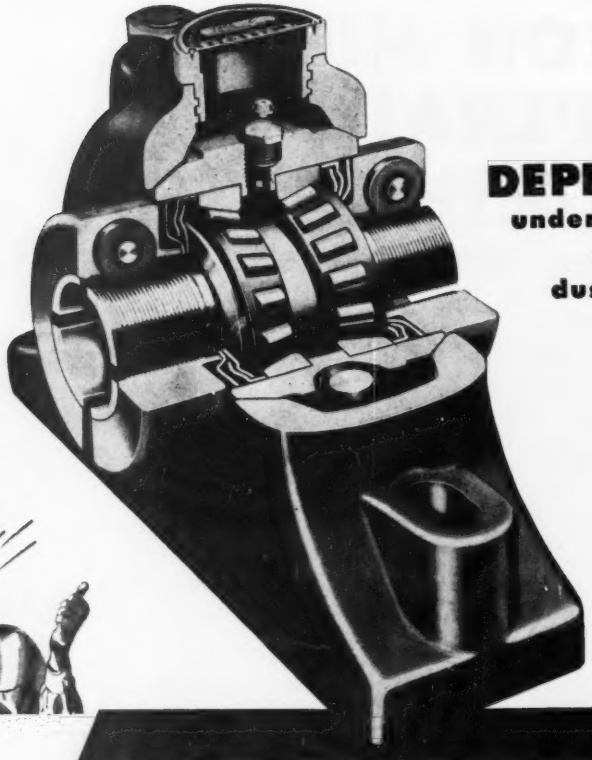

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- Normally available from Dodge Distributors' stocks, sizes from 1-7/16" to 4-15/16".

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TORQUE-ARM SPEED REDUCERS

ROLLING GRIP AND DIAMOND D CLUTCHES

SOLID STEEL CONVEYOR PULLEYS

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and a complete rock bit engineering service!

IF you want to get the best bit for your particular job, go to the Timken Company—the only manufacturer who makes *all three* types of rock bits:

1 **MULTI-USE.** Gives lowest cost per foot of hole when full increments of drill steel can be drilled and when control and reconditioning of bits are correct.

2 **CARBIDE INSERT.** For drilling extremely hard and abrasive ground, smaller holes, extra deep holes. Holes go down faster, bit reconditioning is minimized.

3 **ONE-USE "SPIRALOCK".** To use where reconditioning is not feasible—where circuit control of bits is difficult or impossible. Gives lowest unit cost of the three. "Spiralock" union holds bit on dependably, permits easy removal.

Because the Timken Company makes all 3 rock bit types and can make unbiased recommendations to meet your drilling needs, it offers the only *complete* rock bit engineering service. Backed by 20 years' experience in solving rock bit problems, our rock bit engineers will give you the bit performance you're after, whether you're looking for lowest bit cost, lowest cost per foot drilled, greatest possible drilling speed, or any other desired advantage.

FREE BOOKLET! Packed with helpful information. Shows full line of bits. Write The Timken Roller Bearing Company, Rock Bit Division, Canton 6, Ohio. Cable address: "TIMROSCO".

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

... your best bet for the best bit... for every job

Walworth manufactures a complete line of Gate, Globe, Angle, Check, and Lubricated Plug Valves, made of Stainless Steel, Steel, Iron, Bronze, and Special Alloys in a wide range of sizes and temperature-pressure ratings.

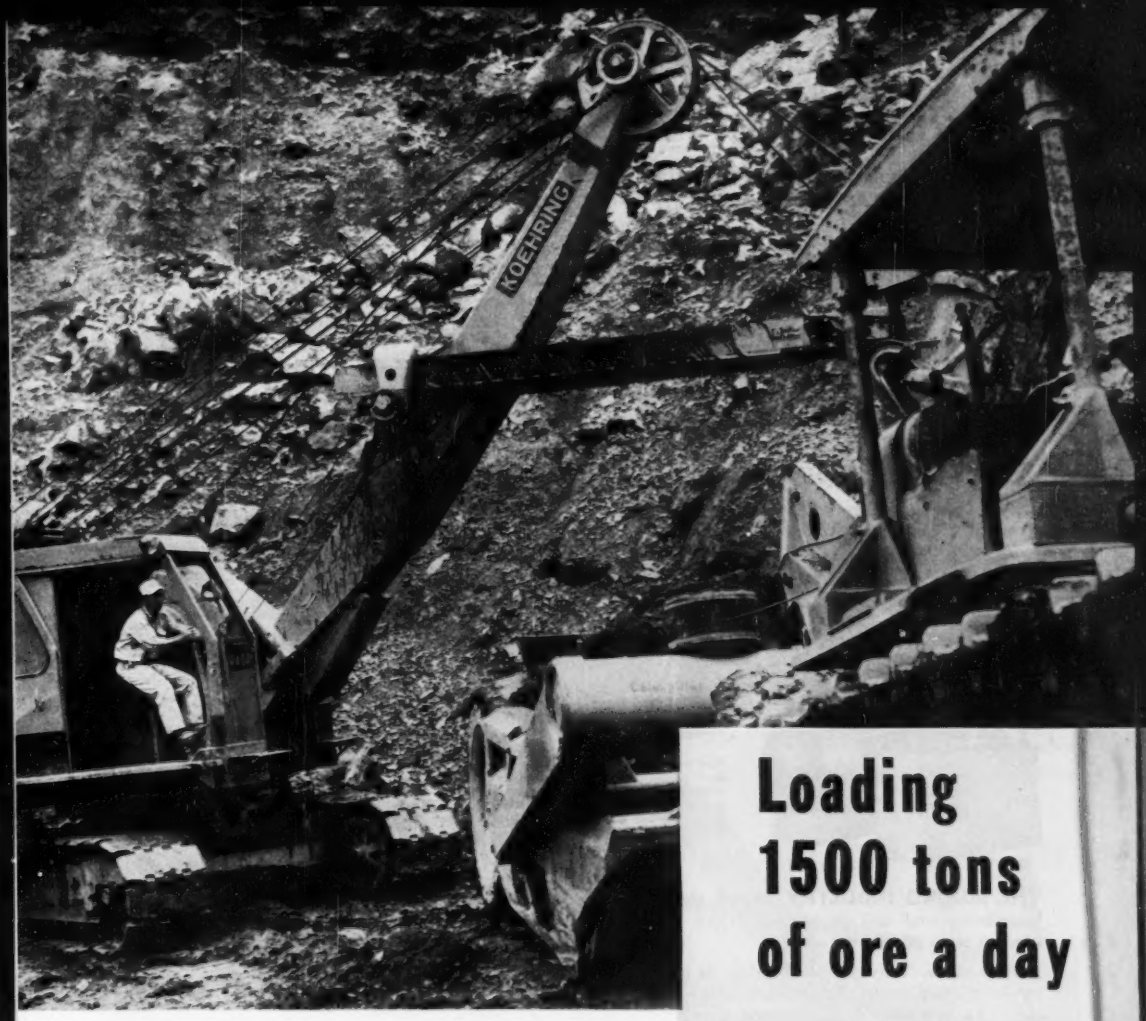
Fittings of steel, iron, and bronze are also manufactured in all conventional types and sizes.

WALWORTH

valves and fittings

60 East 42nd Street, New York 17, N. Y.

Distributors in principal centers throughout the world



Loading 1500 tons of ore a day

THERE'S an interesting mining development in progress north of Joplin, Missouri. Potter and Sims are making a profit out of stripping lead and zinc ore by open-pit methods.

In an area where earlier shafts had been "mined out" they are finding enough ore in veins near the surface to make a real contribution to the supply of metals needed for defense.

At a pit depth of 120 feet, a Koehring 1½-yard shovel, powered by a "Cat" Diesel D13000 Engine, is used to load "Caterpillar" Scrapers, pulled by D8 Tractors. Daily delivery to the mill totals over 1,500 tons of ore-bearing earth.

Dependable "Caterpillar" Diesel Engines are the overwhelming choice of manufacturers who build shovels, compressors and other powered equipment. Tough, simple and easy to operate, these engines have a reputation for standing up on the job and making money for owners.

Right now it's more important than ever to take good care of all your equipment. Proper lubrication and mechanical attention take only a few minutes a day, but they pay big profits in long, trouble-free work life. And when repairs are needed, you can count on your "Caterpillar" Dealer for prompt, efficient service.

CATERPILLAR

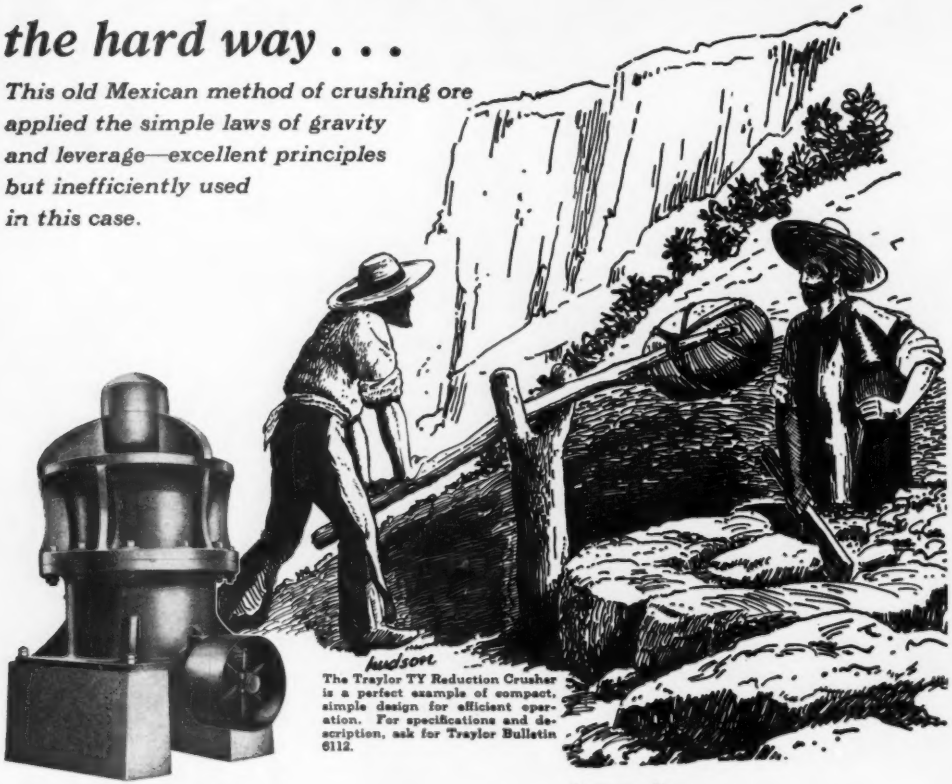
REG. U. S. PAT. OFF.

DIESEL ENGINES
TRACTORS • MOTOR GRADERS
EARTHMOVING EQUIPMENT

CATERPILLAR TRACTOR CO. • PEORIA, ILLINOIS

the hard way . . .

This old Mexican method of crushing ore applied the simple laws of gravity and leverage—excellent principles but inefficiently used in this case.



The Traylor TY Reduction Crusher is a perfect example of compact, simple design for efficient operation. For specifications and description, ask for Traylor Bulletin 6112.

THE MINING INDUSTRY passed through many interesting and unique phases before reaching its modern level of efficiency.

For 50 years, Traylor spearheaded its advancement by developing more efficient machinery for crushing ore. As processes and methods changed, Traylor took the lead in supplying new and improved equipment to fit each specialized job.

Mining men know that to solve new problems, there is no substitute for experience. Traylor has experience —half a century of it.

Traylor

ENGINEERING & MANUFACTURING CO.

422 MILL ST., ALLENTOWN, PA.

Sales Offices: New York • Chicago • Los Angeles
Canadian Mfrs: Canadian Vickers, Ltd., Montreal, P. Q.

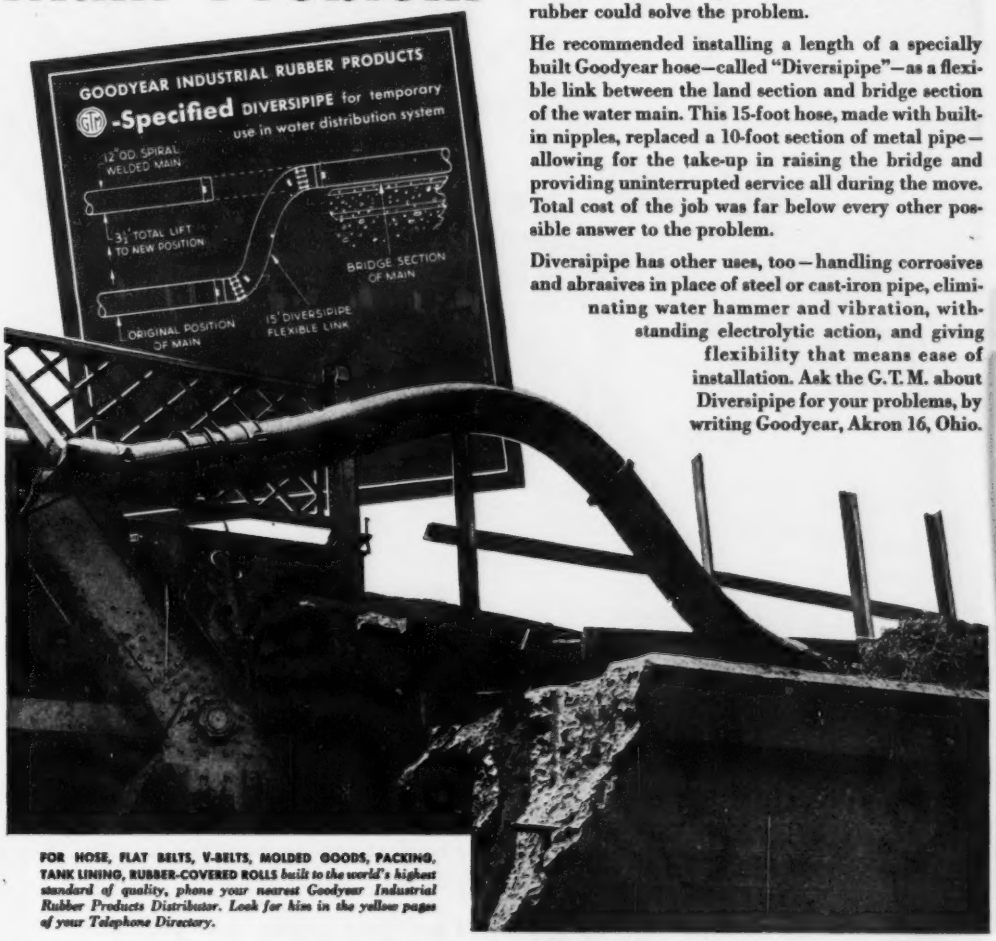
A TRAYLOR LEADS TO GREATER PROFITS

Best Answer to the Main Problem

One end of the bridge you see here had to be raised 3½ feet during a highway-rebuilding project—then anchored at the new height on a new concrete abutment. Problem was this: the bridge carried a water line supplying 400 families, and interruption of service couldn't be allowed during the month and a half it took to do the job. So the project engineer called in the G.T.M.—Goodyear Technical Man—to see if rubber could solve the problem.

He recommended installing a length of a specially built Goodyear hose—called "Diversipipe"—as a flexible link between the land section and bridge section of the water main. This 15-foot hose, made with built-in nipples, replaced a 10-foot section of metal pipe—allowing for the take-up in raising the bridge and providing uninterrupted service all during the move. Total cost of the job was far below every other possible answer to the problem.

Diversipipe has other uses, too—handling corrosives and abrasives in place of steel or cast-iron pipe, eliminating water hammer and vibration, withstanding electrolytic action, and giving flexibility that means ease of installation. Ask the G.T.M. about Diversipipe for your problems, by writing Goodyear, Akron 16, Ohio.


GOODYEAR INDUSTRIAL RUBBER PRODUCTS
-Specified DIVERSIPIPE for temporary use in water distribution system
12" OD SPIRAL WELDED MAIN
3½' TOTAL LIFT TO NEW POSITION
BRIDGE SECTION OF MAIN
ORIGINAL POSITION OF MAIN
15' DIVERSIPIPE FLEXIBLE LINK

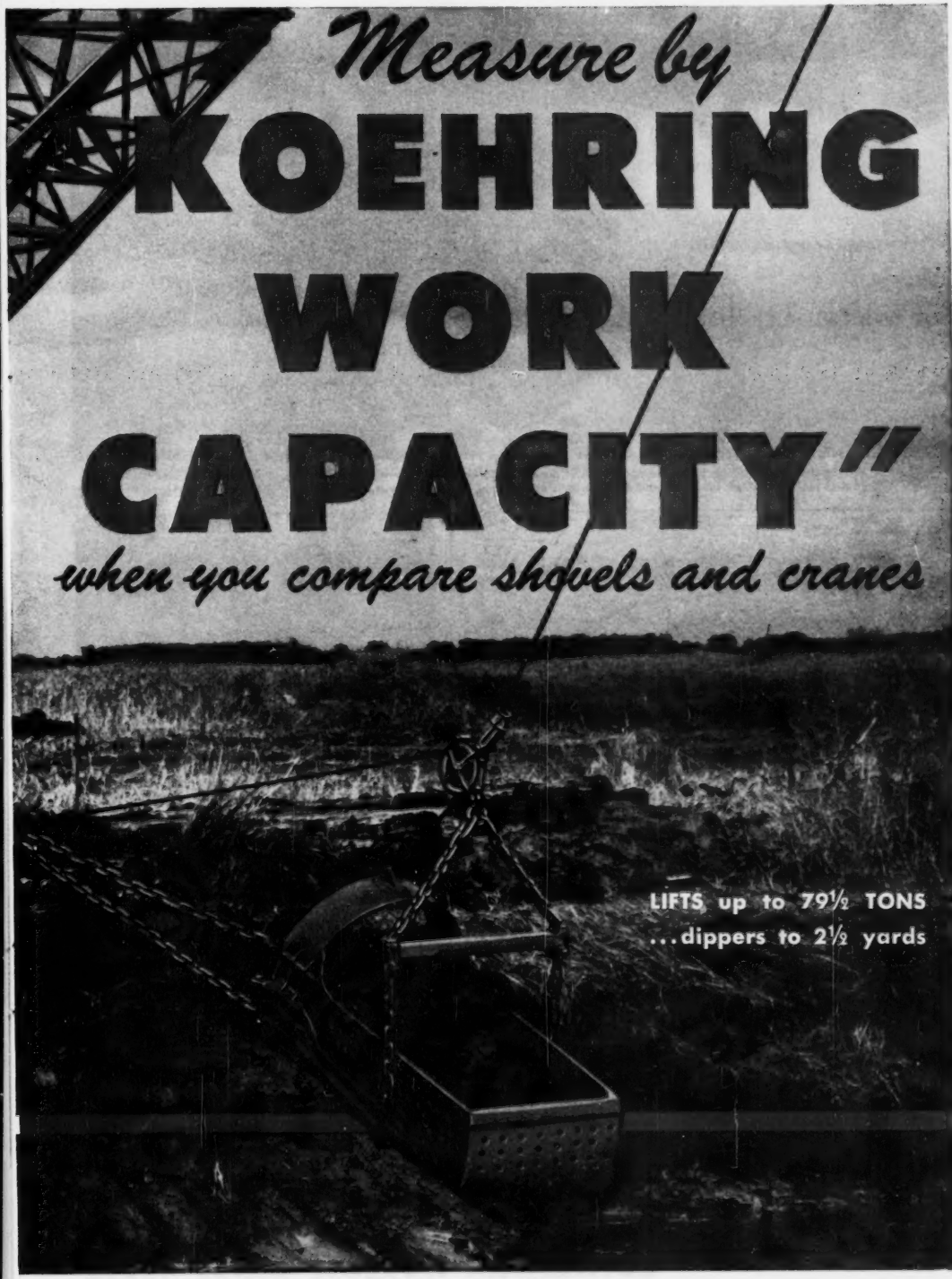
FOR HOSE, FLAT BELTS, V-BELTS, MOLDED GOODS, PACKING, TANK LINING, RUBBER-COVERED ROLLS *built to the world's highest standard of quality, phone your nearest Goodyear Industrial Rubber Products Distributor. Look for him in the yellow pages of your Telephone Directory.*

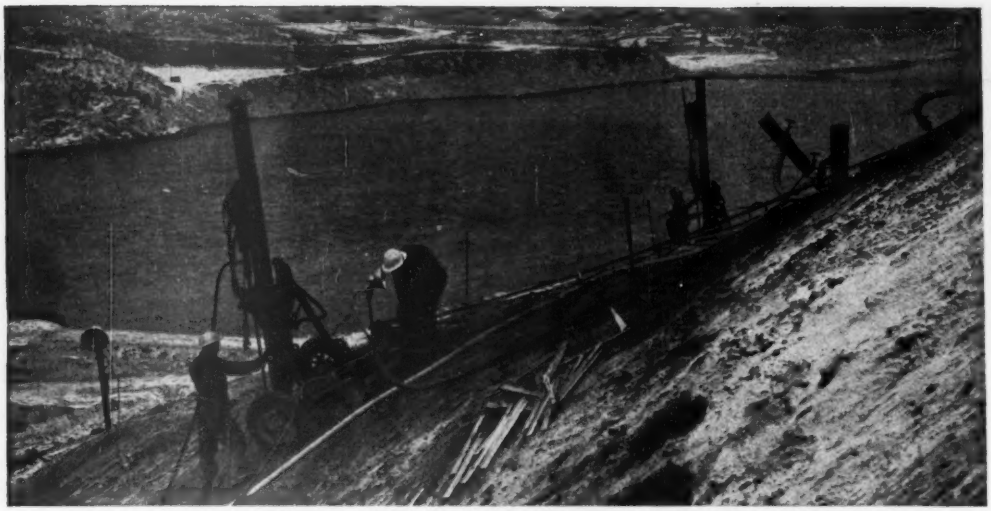
GOODYEAR

THE GREATEST NAME IN RUBBER

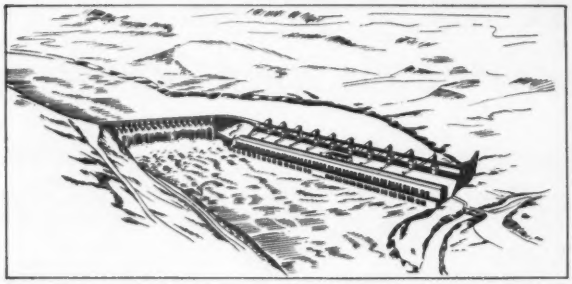
We think you'll like "THE GREATEST STORY EVER TOLD"—Every Sunday—ABC Network

To insure lowest cost per yard moved, or ton lifted . . . compare all excavator and crane information with "KOEHRING WORK CAPACITY". Your Koehring distributor has specific figures that will let you prove for yourself the biggest profit-earning value.
K124
KOEHRING HEAVY DUTY
KOEHRING COMPANY
Milwaukee 16, Wis.
Subsidiaries: PARSONS • JOHNSON • KWIK-MIX


Measure by
KOEHRING
WORK
CAPACITY"
when you compare shovels and cranes
LIFTS up to 79½ TONS
... dippers to 2½ yards



Wagon drills at work high above the north bank of the Columbia River. This impervious glacial till was blasted loose and used in sealing the right bank upstream from the axis of the dam. This contract was held by Peter Kiewit Sons Company.



The powerhouse at Chief Joseph Dam will ultimately house 27 generating units and will be more than 2,000 ft long, making it the longest powerhouse in the world. The project is under the direction of Corps of Engineers, U. S. Army, Seattle District.

This rock mound, under attack by a battery of busy wagon drills using Bethlehem Hollow Drill Steel, was cleared away for the intake channel to the powerhouse. General Construction Company of Seattle held this contract.

Chief Joseph Dam on Columbia River to be Second Largest Power Producer

Chief Joseph Dam will be the second largest hydroelectric power plant in the world, having an ultimate generating capacity of 1,728,000 kw. Now under construction on the Columbia River in Washington, this concrete, gravity-type structure will back up a reservoir reaching 51 miles upstream to the tailrace of Grand Coulee Dam.

The dam, named for the Nez Perce chieftain of 19th Century fame, is scheduled to begin operation in 1955. It is to be 2,260 ft long and 220 ft high. Construction will require the excavation of about 5,500,000 cu yd of rock.

That's a lot of rock, and it calls for good drill steel, steel that can be depended on to keep the drilling on schedule. Right now there is more than 100 tons of Bethlehem Hollow Drill Steel at work at the site of this big dam.

Chief Joseph Dam is the latest addition to the long list of notable jobs on which this "old reliable" of drill steels is playing a big part.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

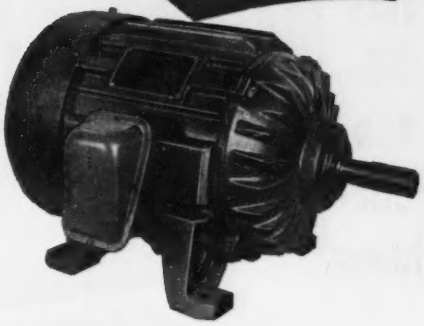
★ BETHLEHEM STEEL ★

BETHLEHEM HOLLOW DRILL STEEL

ALLIS-CHALMERS

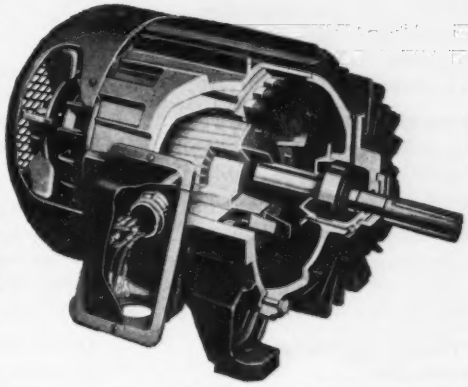
Totally-Enclosed Fan-Cooled MOTORS

Look Outside



Greatly increased radiating area means greater cooling efficiency. More important, cooling efficiency stays high, regardless of operating conditions. There are no enclosed external air passages to clog and cause overheating. If oily dirt sticks, just wipe or blow it off. No matter how bad operating conditions are, this motor can be easily kept clean and cool running. Electrical parts are protected against corrosive atmospheres by cast iron yokes and end housings.

Look Inside



Double-shielded, heavy-duty ball bearings require no maintenance in ordinary service under most conditions. However, they can be lubricated without disassembly if required. Double shielding prevents over-lubrication, leading cause of bearing trouble. Rotating seals, where shaft extends through housings, keep dirt and moisture out of bearing chambers. Die cast rotor and interphase insulation are further assurance of long life and low maintenance.

See WHY THIS IS YOUR BEST MOTOR BUY

HERE IS A MOTOR that is different from conventional TEFC motors; built with an entirely different cooling system that gives you big savings in lower maintenance, more continuous service and less trouble in the toughest locations. Clogging can easily be prevented in the Allis-Chalmers Type APZ TEFC motor since areas that might collect dirt are exposed and easy to clean.

GET DETAILS NOW — *Ask your nearby Allis-Chalmers Authorized Distributor or District Office for more complete information on this high performance TEFC motor. Or write direct to Allis-Chalmers, Milwaukee 1, Wisconsin. Ask for Bulletin 51B7225.* A-3578

Texrope and Vari-Pitch are Allis-Chalmers trademarks.

Sold . . .
Applied . . .
Serviced . . .

by Allis-Chalmers Authorized Dealers, Certified Service Shops and Sales Offices throughout the country.

CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

TEXROPE — Belts in all sizes and sections, standard and Vari-Pitch sheaves, speed changers.

PUMPS — Integral motor and coupled types from ¾ in. to 72 in. discharge and up.

ALLIS-CHALMERS

Increase your production

Check this 50-ton rear-dump

BIG

50-ton, 41-yd. capacity...
Custom-built for your needs... capacity from 35 to 50 tons ... bodies to fit your job.

Power to fit your job ...
Engines from 275 h.p. Diesel to 450 h.p. Butane... will fit your grade haul conditions.

Choice of transmissions...
Conventional sliding-gear type... or constant-mesh type for instant speed changes.

***Torque converter available ...**
Automatically selects proper gear ratio, maximum power at all times, removes shock loads in power train.

17'x13' top on 50-ton body
Speeds up shovel or dragline loading, cuts spill at loader, reduces delays for spotting.

30.00x33 low-pressure tires ...
Give extra traction and flotation, longer tire life... absorb shock, help compact fills.

Power-proportioning differential ...
Delivers 4 times more power to drive wheel on firmest footing, pulls through mud, snow.

Fast, over-the-bank dump
Far more brake per ton than any other hauler. Drive wheels stay on solid ground for safe, fast pull-out.

Positive power steer ...
Push-button control of electric motor geared to king-pin gives safe control in any footing.

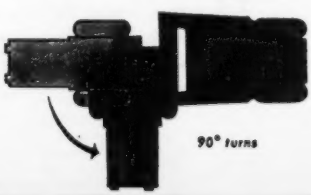
90° turns in 15' radius ...
Big 36' rig turns in less than its own length ... saves time spotting...saves time dumping.

Reinforced steel grid bowl
Floored with ¾" tool steel over grid of 3" steel billets on 8" centers over ½" high carbon steel plate.

Complete self-cleaning ...
Body dumps with floor at 58° angle...induction heating available for winter work.

Simplified, rugged construction ...
No frames, sub-frames, springs, drive shafts, or hydraulic systems to maintain, repair, delay.

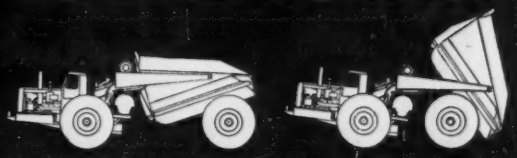
4-wheel air brakes ...
Multiple-disc ... 4792 sq. in. total braking surface, far more than other heavy haulers.



LETOURNEAU LET EQUIPMENT

Your LeTourneau Distributor will be glad to give you application facts and figures on this big "A" Tournarocker.

with model A Tournarocker



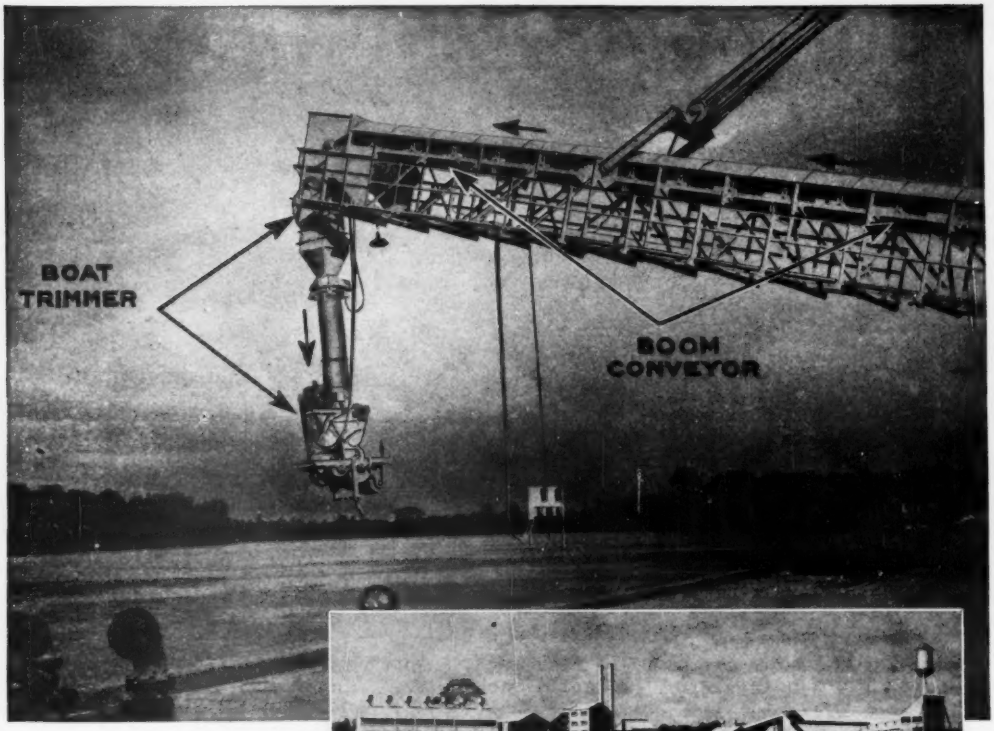
Here are a few of the leading concerns now using high-speed, rear-dump TOURNAROCKERS

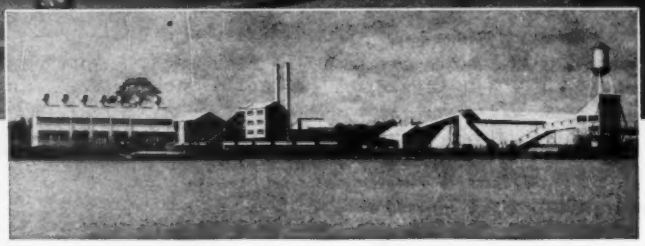
Babler & Rogers.....*Oregon*
Bagdad Copper Corporation.*Ariz.*
Roy L. Bair Co.....*Washington*
Barrage de l'Iril Emda....*Algeria*
Bates & Rogers.....*Illinois*
J. Robert Bazley, Inc.....*Penn.*
Billiton Mines.....*Surinam*
Adolph Bockus.....*Ohio*
Borderland Colleries.....*W. Va.*
Constructores Nacionales...*Mex.*
Dunn Limestone Co.....*Indiana*
Ft. Hartford Stone Quarry....*Ky.*
General Construction Co...*Wash.*
Grand Rapids Gravel Co....*Mich.*
Carl M. Halvorson.....*Oregon*
Horner & Switzer.....*Colorado*
Vernie Jarl.....*Oregon*
Leonard & Slate Ltd.
and E. C. Hall.....*Oregon*
Marsh Construction Co....*Illinois*
McGraw Construction Co....*Ohio*
Monolith Portland Cement Co....
.....*California*
Morrison-Knudsen Co., Inc.....
.....*British Columbia*
Muskoka Construction Co., Ltd...
.....*Ontario*
Nya Asfalt Aktiebolaget and
Svenska Vag Aktiebolaget.....
.....*Sweden*
Fred Onuparik Construction Co...
.....*Connecticut*
Orange Construction Co...*W. Va.*
Republic Steel Co.....*Alabama*
Skousen-Hise Contracting Co....
.....*New Mexico*
John Stark.....*Kansas*
Sydvaranger, A/S.....*Norway*
United Province Government.....
.....*India*
T. W. Ward Co., Ltd.....*England*
Frank W. Whitcomb Construc-
tion Corp.....*New Hampshire*
B. G. Young & Sons....*Tennessee*

Tournarocker—Trademark Reg. U. S. Pat. Off. C 155

R. G. LeTourneau, Inc.

PEORIA, ILLINOIS





S-A Dockside Conveying Equipment

SPEEDS UP SAILING SCHEDULES

Ore boats now make a faster turn-around when picking up processed bauxite at ore deposits in Surinam, Dutch Guiana. S-A engineers provided a complete handling system for greatest speed and efficiency, maximum tonnage and lowest handling cost per ton. Ore is put through preliminary processing and loaded on to ships rapidly —with maximum use of cargo space—at a definite saving in port time per ship.

Because Stephens-Adamson makes all types of bulk material handling equipment, the S-A engineer is free to recommend the best unit for any specific need. S-A engineers are able to draw on 50 years experience in answering many and diversified conveying and bulk materials problems. They have a complete line of equipment to plan with. It pays to consult the S-A engineer. Write today for all details—no obligation!

ALUMINUM COMPANY OF AMERICA
Surinam, Dutch Guiana, S. A.

S-A Belt and Pan Conveyors move ore through crushing, washing and kiln stages. Storage and reclaiming operations are also handled by S-A Belt Conveyors and travelling trippers. Loading ore into a ship's hold is handled by an S-A boom type belt conveyor. An S-A Centrifugal Boat Trimmer unit, fitted to the spout on a swivel connection, throws material in a stream to the far corners of the hold for maximum use of cargo space.

1901-1951

50 years experience with bulk handling

STEPHEN S-A DAMSON MFG. CO.

4 Ridgeway Avenue, Aurora, Illinois · Los Angeles, Calif. · Belleville, Ontario

DESIGNERS AND MANUFACTURERS OF ALL TYPES OF BULK MATERIALS HANDLING EQUIPMENT

You can haul more pay-dirt with MANCHA STORAGE BATTERY LOCOMOTIVES

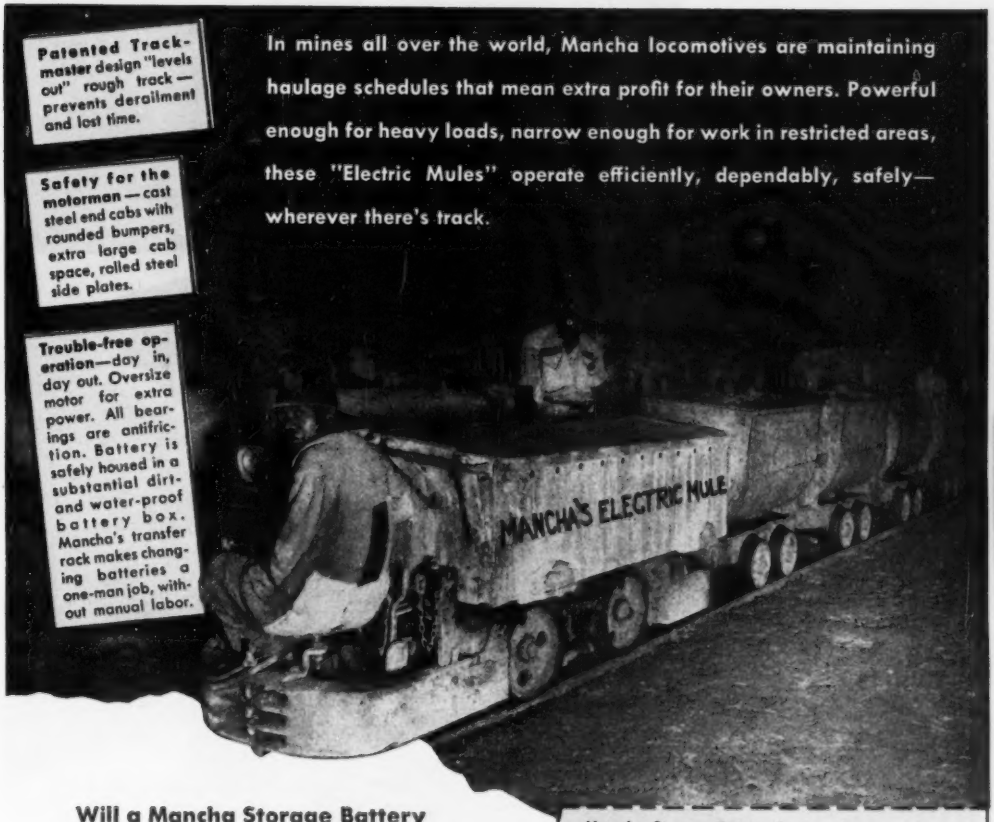
Built for heavy loads, long hauls

Patented Trackmaster design "levels out" rough track — prevents derailment and lost time.

Safety for the motorman — cast steel end cabs with rounded bumpers, extra large cab space, rolled steel side plates.

Trouble-free operation—day in, day out. Oversize motor for extra power. All bearings are antifriction. Battery is safely housed in a substantial dirt- and water-proof battery box. Mancha's transfer rack makes changing batteries a one-man job, without manual labor.

In mines all over the world, Mancha locomotives are maintaining haulage schedules that mean extra profit for their owners. Powerful enough for heavy loads, narrow enough for work in restricted areas, these "Electric Mules" operate efficiently, dependably, safely—wherever there's track.



Will a Mancha Storage Battery Locomotive pay in your mine?

Whether or not you are in the market for new haulage equipment . . .

YOU CAN HAVE THE ANSWER NOW!

Mail the coupon today for our "mine haulage questionnaire." Return it to us with your answers to the questions, and we will tell you if a Mancha locomotive will save you money as it does daily for scores of mine operators.

We make a complete line of storage battery locomotives for all classes of service.

Mancha Storage Battery Locomotive
Division GOODMAN Manufacturing Company
4850 South Halsted Street, Chicago 9, Ill., U.S.A.
E&MJ-252

Send Your Mine Haulage Questionnaire.

NAME.....

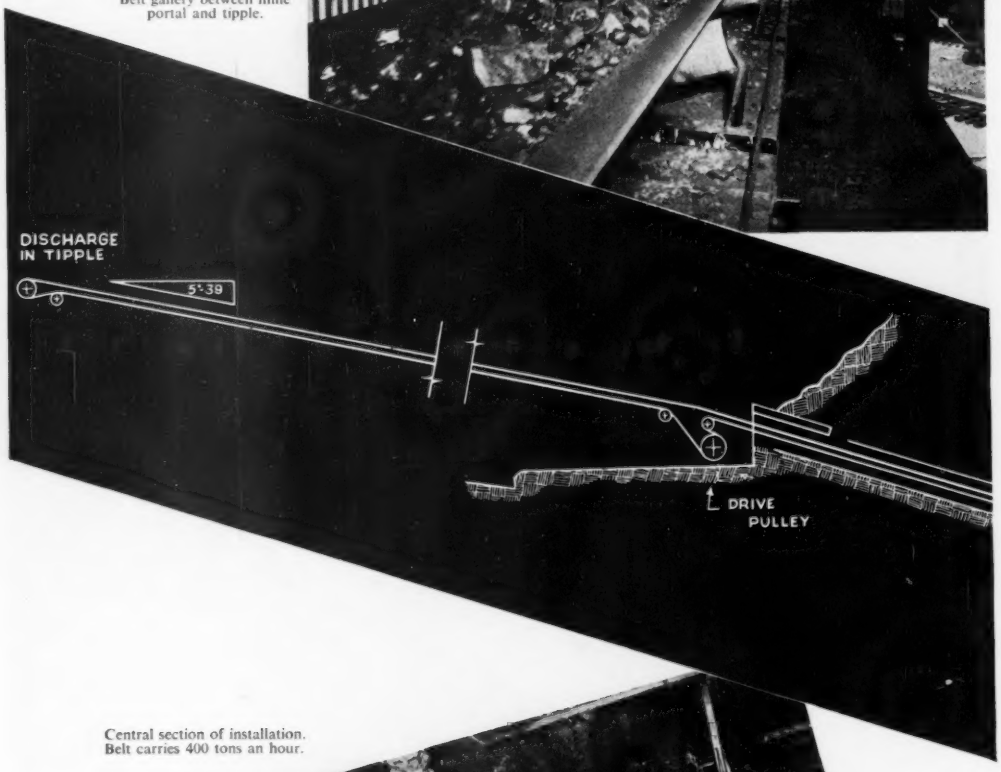
FIRM.....

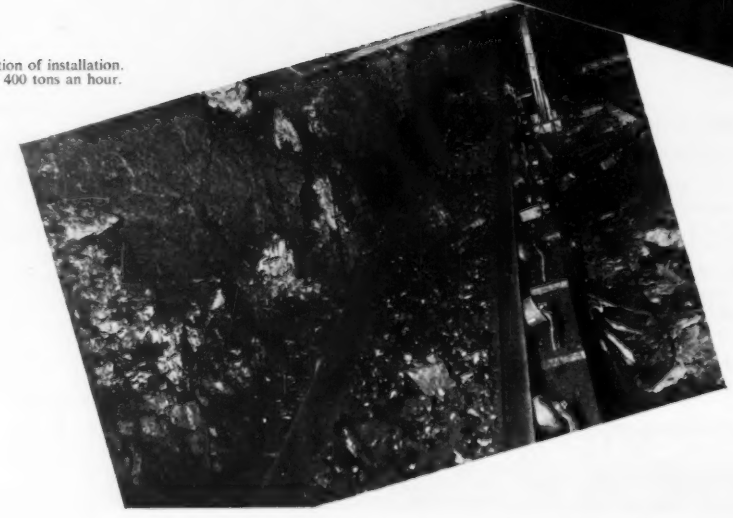
ADDRESS.....

CITY.....ZONE....STATE.....

MANCHA STORAGE BATTERY LOCOMOTIVE
Division GOODMAN Manufacturing Company
4850 SOUTH HALSTED STREET CHICAGO 9, ILL., U. S. A.

Belt gallery between mine portal and tipple.





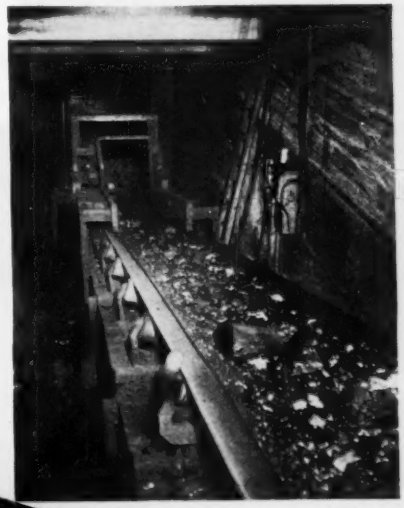
Central section of installation. Belt carries 400 tons an hour.

What's U. S. Rubber's Ustex-Nylon Conveyor Belt Doing at a Pond Creek Pocahontas Mine?*

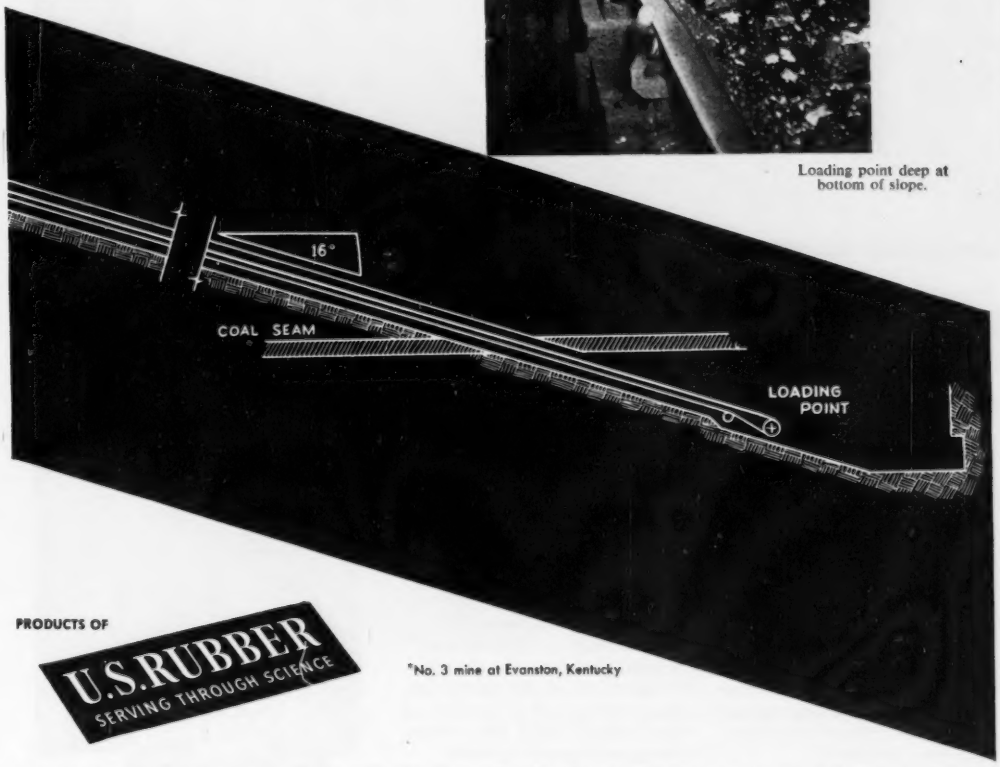
It is raising 400 tons per hour of bituminous coal a vertical distance of approximately 2½ times the height of Niagara Falls! This U. S. Rubber belt consists of a special fabric which combines Ustex® and nylon to provide the following outstanding features:

High-tensile strength • optimum troughability for true alignment • low stretch • greater resilience for dissipation of shock and impact • superior transverse strength for load support and resistance to ripping and tearing • high strength-weight ratio.

If you have a materials handling problem with coal, rock, ore and other bulky materials, write to address below.



Loading point deep at bottom of slope.



PRODUCTS OF U.S.RUBBER SERVING THROUGH SCIENCE

*No. 3 mine at Evanston, Kentucky

UNITED STATES RUBBER COMPANY

MECHANICAL GOODS DIVISION • ROCKEFELLER CENTER, NEW YORK 20, N. Y.

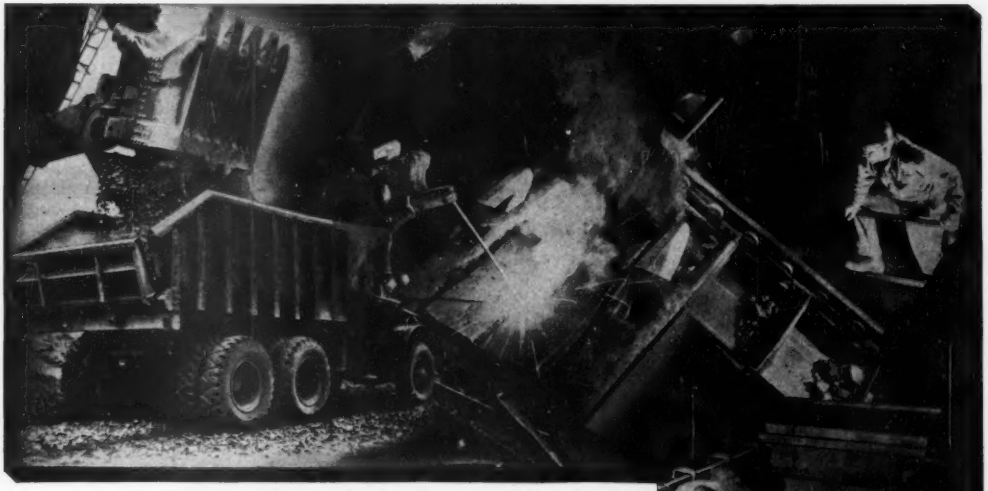
On the *TOUGH* Jobs Operators know

JALLOY HEAT-TREATED PLATES

J&L STEEL

. . . resist impact, abrasion and corrosion

. . . provide longer service life, lower maintenance costs



Cost-conscious mine operators throughout the industry are cutting maintenance and downtime costs by installing tough J&L Jalloy heat-treated steel plates on their equipment.

They've found that on the tough applications heat-treated Jalloy lasts 4 to 20 times longer than mild steel. The reason—Jalloy has the physical properties to resist the severe impact, abrasion and corrosion of mining operations. It is produced with a yield strength of 160,000 lbs. per sq. in. and a Brinell hardness of 341 to 388. The result—Jalloy saves money by cutting steel requirements, reducing downtime for repairs and replacement, and keeping labor costs for maintenance to a minimum.

Here are some of the applications where mine operators are using heat-treated Jalloy—Dump Truck Bottom Liners, Coal, Rock and Ore Chute Liners, Dipper Stick, Shovel and Drag Bucket Reinforcing. You can get Jalloy in bar form and in plates up to 72" wide and 20' long with thicknesses from $\frac{3}{16}$" to $1\frac{1}{2}$".

Start finding out more about Jalloy today. Just write to Jones & Laughlin Steel Corporation, 412 Jones & Laughlin Building, Pittsburgh 30, Pa. We'll send you a free copy of our booklet, "For Longer Wear . . . Less Repair!" It will give you more complete information on the properties, heat treating and workability of heat-treated Jalloy, the modern mining and quarrying steel.

JONES & LAUGHLIN STEEL CORPORATION

PITTSBURGH 30, PA.

get FULL VALUE loading...
choose GARDNER-DENVER Mine Car Loaders

a FULL *dipper every bite . . .*

because two high torque air motors function together on the powerful crowding action—and the Gardner-Denver moving fulcrum provides extra force for digging into stubborn muck piles.

FULL *to the top mine car loads . . .*

Extra speed developed by the moving fulcrum as the dipper nears discharge position throws the ore far back to completely fill your big capacity mine cars.

FULL *time availability . . .*

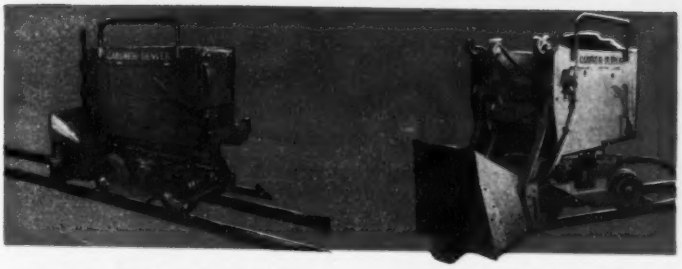
Heavy-duty construction, fewer moving parts and protected lubrication keep Gardner-Denver Mine Car Loaders underground—enable you to plan on using your Gardner-Denver Loader 'round the clock, at several different faces.

FULL *measure of safety . . .*

Low center of gravity, clean exterior design, simple and convenient controls and other safety features protect your miners against injury.

Send today for Bulletin MCL.

Gardner-Denver Loader quickly cleans up a round of coarse, abrasive muck.



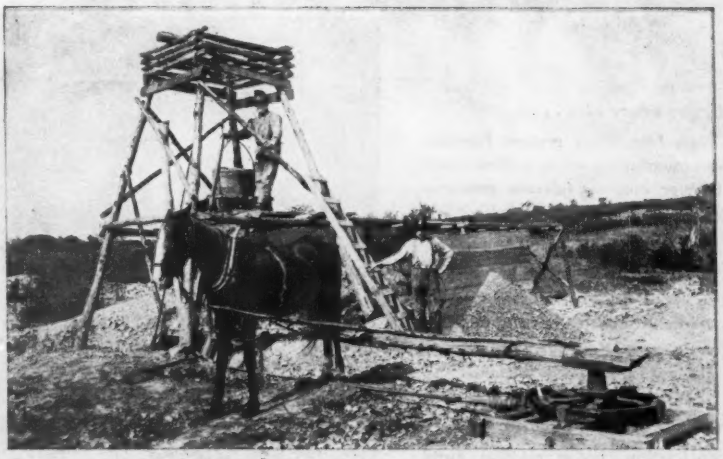
The smaller GD9 Mine Car Loader—for fast loading in low or narrow headings.

The GD14 "Big Bite" Loader—for high tonnage loading into big mine cars.

SINCE 1859 **GARDNER-DENVER**

Gardner-Denver Company, Quincy, Illinois
In Canada: Gardner-Denver Company (Canada), Ltd., Toronto, Ontario

THE QUALITY LEADER IN COMPRESSORS, PUMPS AND ROCK DRILLS



HORSE HOIST DAYS

Dobbin went round and round...and the rock comes up in a wooden pail. Missouri lead mine about 1890.

An enlargement of this photo suitable for framing is yours for the asking.

Times Have Changed . . .

Hoisting rock with living horsepower, old-fashioned blasting methods and other inefficient mining techniques have become so obsolete that no operator could afford to use them today.

Times have changed . . . and so have blasting methods!

The latest major development in underground blasting techniques is the use of milli-second delay detonators—pioneered by Atlas in the ROCKMASTER® Blasting System. With proper drill pattern and loading, the one-two punch of split-second detonation gives breakage never before possible in hard rock mining. And there's no substitute for good breakage to assure maximum production from loading, hauling and crushing equipment.

Are your blasting methods up-to-date? You can find out by sending for the free 20-page booklet on ROCKMASTER blasting. It will pay you to investigate!

ATLAS EXPLOSIVES

"Everything for Blasting"

CHEMICALS ATLAS EXPLOSIVES

ATLAS POWDER COMPANY, Wilmington 99, Del. • *Offices in principal cities* • *Cable Address—Atpowco*

How good are you at selecting Wire Rope?

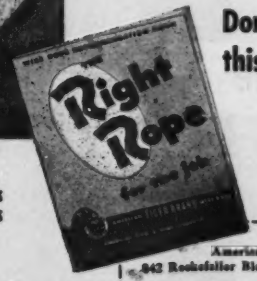
The right choice may save you 25% to 50%

● For every job, there are a number of possible choices of wire rope — but there is usually one best choice. *The wrong choice may cut your wire rope service in half.*

Our new book, "The Right Rope for the Job" gives a complete listing of the correct rope to use for each application in a wide variety of industries. This information, prepared by experienced wire rope engineers,can definitely help you reduce your wire rope costs.

If your particular conditions are not covered, the Tiger Brand Wire Rope Specialist in your area will gladly help you determine the best ropes for your particular needs. It's to your advantage and ours, too, that you get the Tiger Brand Rope that will give you the best service. Send the coupon for a copy of the book and check your choice of ropes.

In the period ahead you will want the best rope you can get—and that's American Tiger Brand.



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UNITED STATES STEEL EXPORT COMPANY, NEW YORK

U·S·S AMERICAN TIGER BRAND WIRE ROPE

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American Steel & Wire Division
942 Rockefeller Bldg., Dept. C-2, Cleveland 13, Ohio

Please send me your Recommendation Book, "The Right Rope for the Job."

Name..... Position.....

Company.....

Address.....

City..... Zone..... State.....

UNITED STATES STEEL

They did...

Kennecott saw the advantages of maximum production and lower costs through modern electrical equipment.

what...

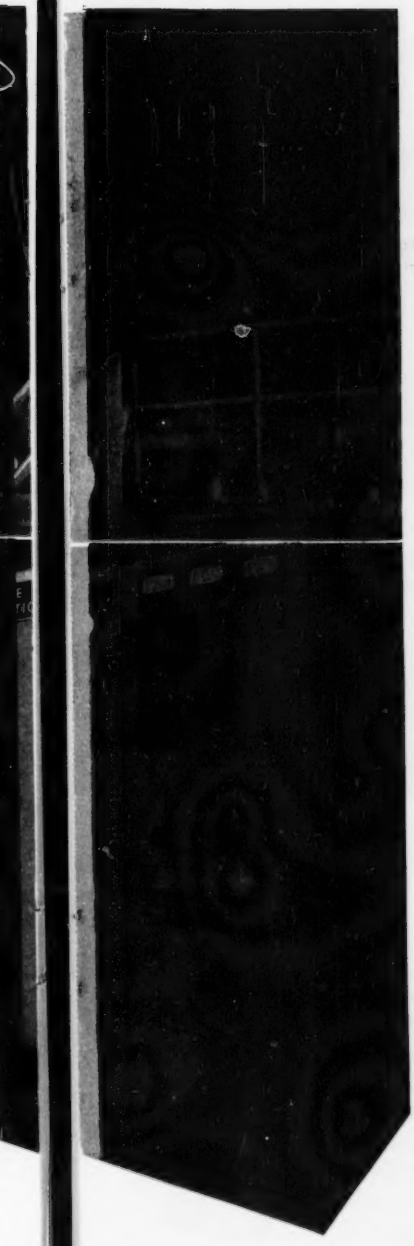
They had Westinghouse help develop *co-ordinated electrical systems*—based on our previous experience with similar installations.

you can do...

Do what hundreds of other mining firms are doing. Have Westinghouse work with your engineers and consultants in applying modern equipment in your electrical operations.

to produce more

Whether it's a complex electrical system, better servicing, or simply a piece of electrical equipment to do a tough job, Westinghouse has the answer.



Two Modern Production Techniques at Kennecott's new refinery

Here are two interesting production ideas in operation at the new Kennecott Copper refinery at Garfield, Utah—(1) the large Lectromelt arc furnaces used for melting and (2) the method of supplying d-c power for cranes and auxiliaries.

Furnace output 2 or 3 times that of reverberatory types

Three large Westinghouse-equipped Lectromelt furnaces melt the electrolytic copper. Each furnace is a continuous melting unit and produces at a high rate. Accurate control and absence of combustion produce a high-quality product. There's no possibility of fuel contamination and no need for poling.

Westinghouse makes all furnace equipment

All electrical equipment for use with the furnaces was supplied by Westinghouse. Furnace transformers have the Westinghouse shell-form construction, inherently much stronger and better-cooled than core-type design. The Westinghouse air circuit-breakers operate about 15,000 times between inspections—as against 2,000 times for conventional furnace breakers. Furnace control is Westinghouse ROTOTROL® which responds fast and accurately maintains proper melting conditions.

D-C power supplied at low cost

Another major item of equipment at Kennecott is the Westinghouse Ignitron substations which turn out d-c power for cranes. These rectifiers have no major moving parts and need very little maintenance or attention. In two years of service there have been no tube failures. The units average about 6% higher efficiency than corresponding motor-generator sets and they cost considerably less to buy and install.

Call Westinghouse for ALL mining apparatus

The results at Kennecott are typical of the performance of *all* Westinghouse equipment for mining. When your next job comes up, get in touch early with your nearby Westinghouse office. Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pa.

J-94880

YOU CAN BE SURE... IF IT'S

Westinghouse

EQUIPMENT FOR THE MINING INDUSTRY

TYPE "S" IS BEST

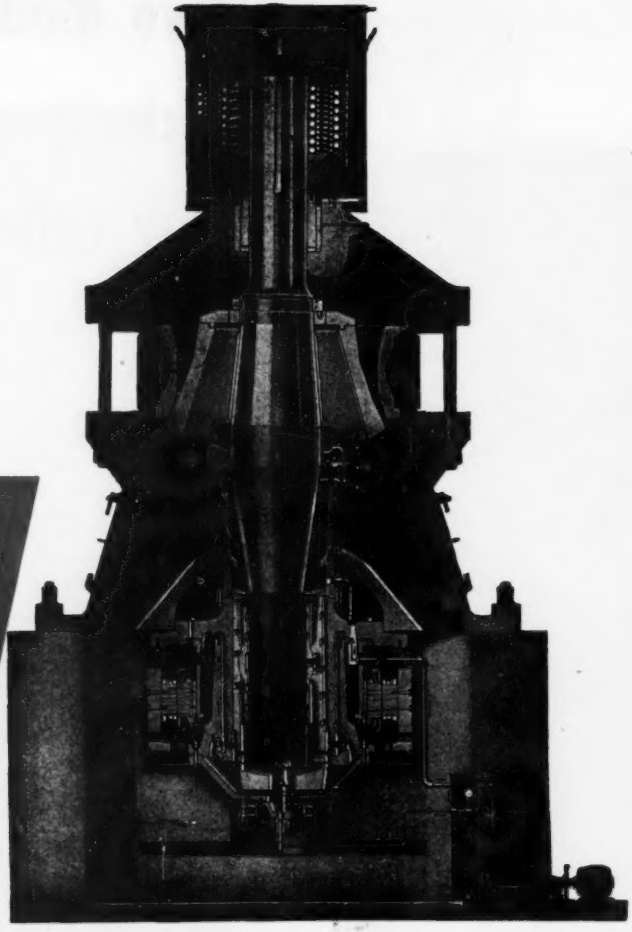
You can't beat the old saying — "Best by test." Just study these:

GRADATION FIGURES ON CLOSED CIRCUIT OPERATION

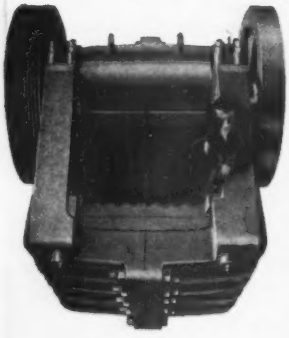
+3.8%	M		MESH
33.3	"	4	"
20.8	"	6	"
12.6	"	8	"
16.1	"	10	"
13.1	"	14	"
	"		"

These above results were obtained from four No. 37½ Kennedy type "S" Roller Bearing Gyratory Crushers. Feed opening 6¼". Discharge 7/32". Capacity of each crusher 56 tons per hour; power requirements 48 h.p. each.

Here are the results of another test run! A Kennedy No. 37½ Crusher with a Special Grinding Ring 3" Feed Opening gave 40% more product (and a finer, better product at that) for about HALF the power cost of a competitive crusher of comparable size. With power costing say 1 cent per h.p. hour, this KVS saved some 40 h.p. (or about $11.00 daily) or around $3,000 a year.



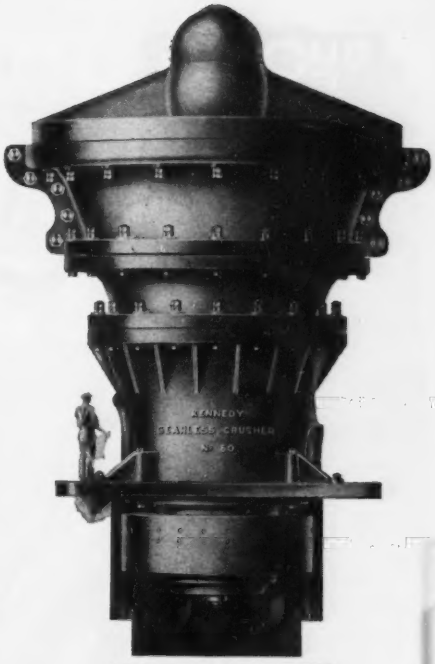
SWING TO ECONOMY..



Swing to lower power costs in the "KVS" Swing Jaw Crusher. The "KVS" STATIONARY jaw now carries 50% of the crushing load, instead of leaving it all to the SWING jaw. Another thing we cut way down is PARTS TROUBLE. The swing jaw is ALL IN ONE PIECE, except for the crushing plate. And that is removable and renewable. Note also — Swing and Stationary jaws are INTERCHANGEABLE, reversible end for end. This means DOUBLE jaw-crushing life.

CRUSH MORE AT LESS COST

Yes—it can be done! In grandpa's day, the big whirling flywheel or pulley of an old Corliss Engine produced extra KINETIC ENERGY! In other words, added FREE power! TODAY the BIG Revolving Pulley in the "KVS" Gearless does the same thing—it revolves at 4,500 ft. per minute—EXTRA crushing power for more production without extra cost. The 11 ton pulley (in a "KVS" Gearless Crusher weighing 400,000 lbs.) turns so easy you can turn it on its roller bearings with TWO FINGERS! In simple words—more CRUSHING with LESS POWER COST. Less vibration and less NOISE, too, put the "KVS" Gearless way out in front—and performance proves it!



BE $5,000 + RICHER!

Thinking of buying a 10' diameter ball mill? Get out your pencil. You can save $5,000 more, by buying a "KVS" Mill with INTEGRAL GEAR drive and using a SYNCHRONOUS MOTOR DIRECT CONNECTED to drive shaft. Pinion shaft runs about 600 r.p.m. Pinions in other mills run at about 180 r.p.m. "KVS" trunnions on large sized tube and ball mills CARRIED ON OIL. Bearing never wears out, uses little power. All gears and bearings automatically oil-sprayed before mill is started (design pat'd). In 15 years on this type mill no "KVS" gears or pinions worn out.

WRITE today for complete set of "KVS" Bulletins if you want more production with LESS cost.

Kennedy-Van Saun
MANUFACTURING & ENGINEERING CORPORATION
2 PARK AVE., NEW YORK 16, N. Y.
FACTORIES:
DANVILLE, PA., U.S.A.

BUCYRUS ERIE 6 YARD

150-B Brings POWE

NEW SPEED, R, CAPACITY

to loading and stripping

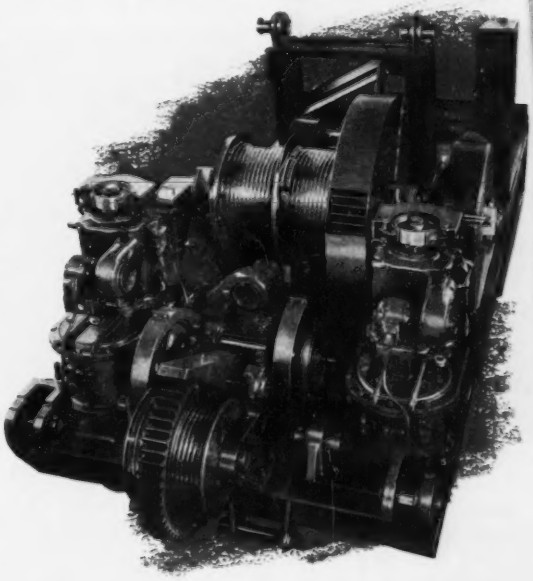
ADDED to the time-proved superiorities of design and construction which have made Bucyrus-Erie quarry and mining shovels traditionally "years ahead" are important features new to an excavator of this size, yet *thoroughly proved in the field*. Among these 150-B features are:

Exclusive Two-Section Boom with tubular dipper handle free to rotate in saddle block. Used with outstanding success on Bucyrus-Erie's large stripping shovels, this design speeds the working cycle and permits increased *payload* because it reduces front end weight materially yet provides enormous strength. Upper section carries only load resulting from pull of ropes, strong trussed lower section transmits directly to the revolving frame the vibrations, torsional and shock loads set up in digging. Rope crowd is quiet, positive, with crowd machinery located on the deck.

Powerful New Main Machinery designed for double twin hoist smoothly delivers power where you want it, when you want it. Hoist machinery pulls dipper straight through tough banks with steady positive action. Fast, smooth swing, with quick acceleration and deceleration, shaves seconds off every cycle.

Larger Stronger Mounting has new propelling machinery arrangement, which provides rapid engagement of the propel for fast move ups. Cored box-section tread links have separate flame hardened wearing paths for rollers and driving tumblers. Cat belts have high wear resistance, stay in adjustment for long periods.

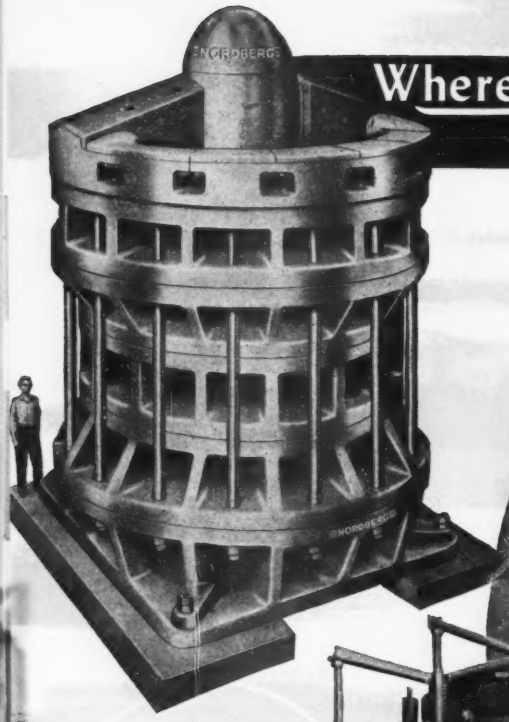
The 150-B has full Ward Leonard independent motor control, is fully convertible to dragline service, features numerous other design advances that make it truly "years ahead". 1152C

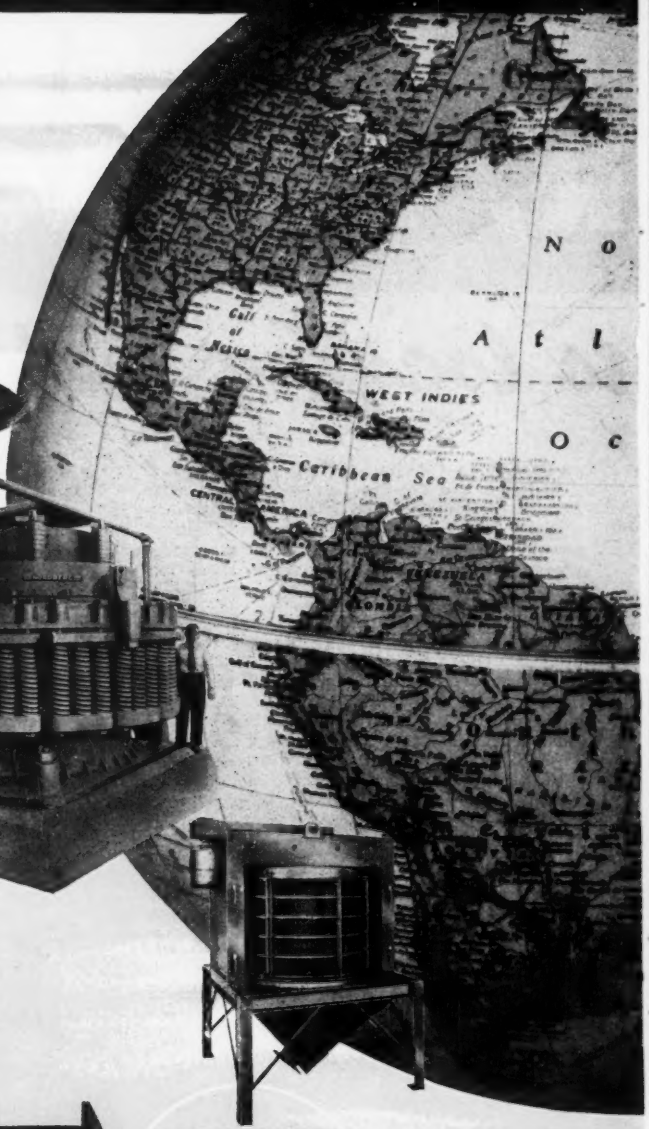


BUCYRUS-ERIE COMPANY

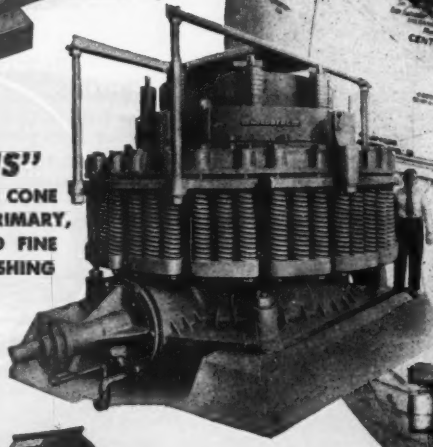
South Milwaukee, Wisconsin

Wherever ores are processed . . .

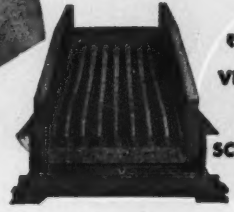




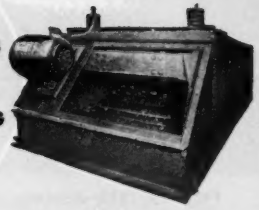
"SYMONS"
GYRATORY AND CONE CRUSHERS FOR PRIMARY, SECONDARY AND FINE REDUCTION CRUSHING



BALL, TUBE, AND ROD MILLS FOR WET AND DRY GRINDING



"SYMONS"
VIBRATING GRIZZLIES AND VIBRATING SCREENS FOR SCALPING and SIZING



M152

FOR BASE METALS . . . PRECIOUS METALS . . .
THE RARER ELEMENTS . . . NON-METALLICS AND MINERALS . . .

NORDBERG

MINING MACHINERY

is the *outstanding choice* of producers

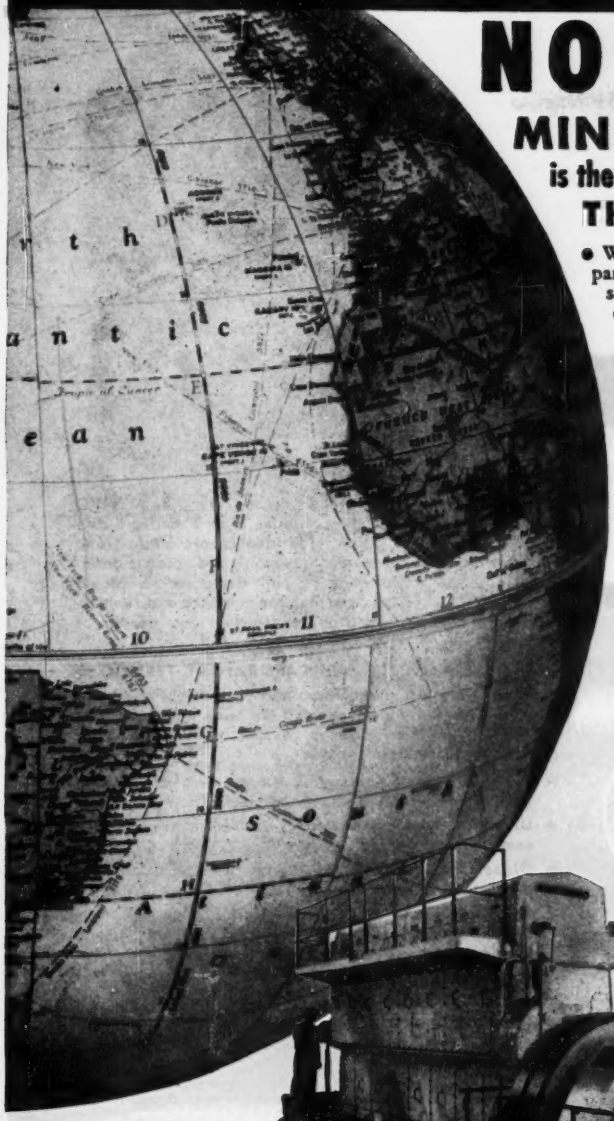
THE WORLD OVER!

● Without the vast ore processing operations in all parts of the globe, all industrial capacity would be seriously hampered. And without efficient, large-capacity mining machinery, these ore and mineral processing operations would fall far short of their required output.

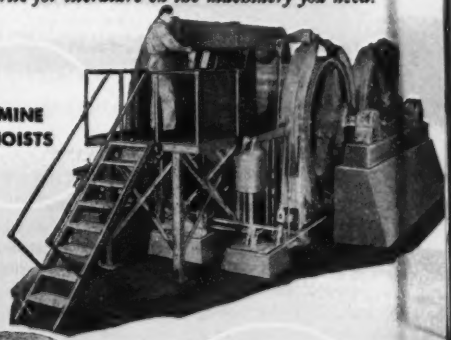
It is highly significant that *wherever* mineral resources are found in quantity — efficiency minded producers are now using, or are in the process of installing, Nordberg Mining Machinery.

This dependable Nordberg Machinery is designed and built especially for the Mining Industry . . . and includes Mine Hoists; *"SYMONS"* Gyratory Crushers for primary breaking; *"SYMONS"* Standard and Short Head Crushers for fine reduction crushing; *"SYMONS"* Vibrating Grizzlies and Screens for scalping and sizing; Grinding Mills for wet or dry grinding; and a complete line of heavy duty Nordberg Diesel Engines in sizes from 10 to 10,000 H.P.

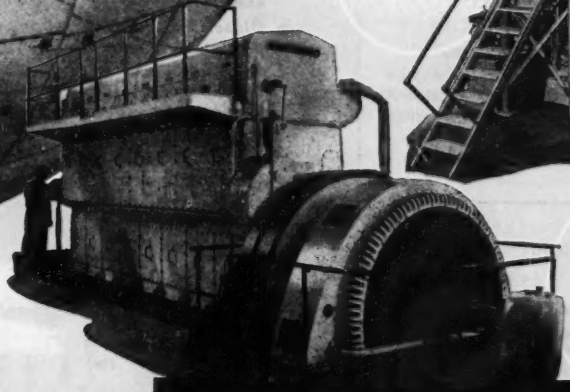
Write for literature on the machinery you need.



Globe copyrighted by Rand McNally & Co.



MINE HOISTS



DIESEL ENGINES
2 and 4-cycle—
10 to 10,000 H.P.
Burn Gas, Oil or any combination of both

"SYMONS" . . . a Nordberg trade mark known throughout the world.

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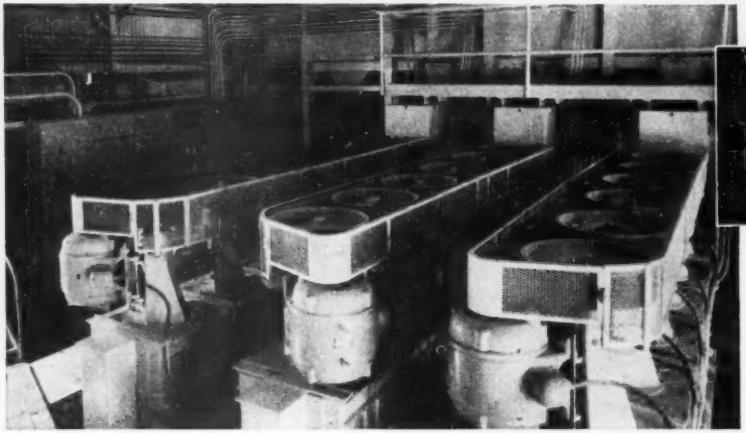
ANNOUNCING! a New Metallurgical Tool

THE WEMCO ATTRITION MACHINE



Views of WEMCO Attrition Machines in operation.

Opening an extensive range of new mineral dressing possibilities, the field proven WEMCO Attrition Machine fits two important classes of metallurgical applications: (1) Treatments to make subsequent processing possible where other means have failed or proven too costly, and (2) Direct improvement of mineral products to meet market specifications.

APPLICATIONS

Treatment of Particle Surfaces

- Removal of oxidized coatings
- Elimination of slime coatings
- Removal of reagent coatings
- Surface polishing of particles

Liberation of Cemented Minerals

Ores or industrial minerals of this type may be separated, either the particles or the cementing material being recoverable for valuable mineral content.

PRINCIPLE OF OPERATION

By controlled turbulence of high density pulps, the WEMCO Attrition Machine thoroughly abrades mineral and ore particles. The imparted action is decidedly more efficient and complete than similar treatment previously attempted in grinding mills. Power consumption is greatly decreased, averaging 3½ to 7 kw. per ton of capacity. Maintenance and replacement costs are lowered to approximately 1 cent per ton of output.

PLANT OPERATIONS AND LABORATORY TESTING

Many months of actual plant operation and extensive laboratory programs have demonstrated the wide adaptability of the WEMCO Attrition Machine. Results obtained on a few of these ores are shown below:

- ***Tungsten ore*** — *Substantial improvement of flotation grade and recovery in the retreatment of former tailings.*
- ***Uranium ores*** — *Liberation of uranium minerals in the cementing material of sandstone.*
- ***Glass sand production*** — *Removal of iron oxide stain to meet market specifications.*
- ***Aggregate and sand production*** — *Disintegration of sand and clay cementing material from aggregate, saving both aggregate and sands for marketing.*
- ***Sulfide ores*** — *Removal of semi-oxidized coatings, making flotation separation possible.*
- ***Gold ores*** — *Greatly increased flotation recovery by removal of reagent and oxide coatings on former tailings.*

WRITE TODAY for further information pertaining to your problem. If desired, WEMCO's mineral testing laboratory is prepared to make attrition tests on samples of your ores and industrial minerals.

OTHER **WEMCO** PRODUCTS

Mobil-Mills • Coal Spirals • HMS Thickeners • HMS Pumps • Sand Pumps Cone Separators • Drum Separators • Fagergren Laboratory Units • Agitators Fagergren & Steffensen Flotation Machines • Hydroseparators • S-H Classifiers HMS Laboratory Units • Dewatering Spirals • Thickeners • Conditioners • Densifiers

WEMCO

WESTERN MACHINERY COMPANY

760-786 FOLSOM STREET · SAN FRANCISCO 7, CALIFORNIA

Saginaw Dock & Terminal Co. reports that

Belt reinforced with "Cordura" rayon holds trough on long slope conveyor

STRONGER AND THINNER, this "Cordura" rayon reinforced belt measures 912 feet between centers. It can deliver 2½ tons a minute up a 245-foot lift on a 16 degree slope. Driven by a 50-horsepower motor through a gear-speed reducer, it travels at a speed of 280 feet per minute.

Under any loading condition, this 30-inch slope belt at Saginaw Dock and Terminal Company's # 1 mine at St. Clairsville, Ohio, trains perfectly. It was manufactured by the Goodyear Tire and Rubber Company on a 4-ply fabric carcass made of Du Pont Cordura* High Tenacity Rayon.

Why do belts train better when reinforced with "Cordura" rayon? Here's the reason. "Cordura" rayon yarn is stronger than yarn of natural fibers. It will make a belt full strength with fewer plies. These thinner belts are more flexible and so trough better. Besides, the low stretch of "Cordura" rayon saves costly shut-downs for take-up and resplicing.

Before you order your next conveyor belt, be sure to look into the advantages of belts reinforced with this heavy-duty Du Pont yarn. We'll be glad to send you a list of the names of suppliers, and full information about "Cordura" rayon in a new booklet, "Sinews for Industry." For your free copy, address: Rayon Division, Room 4421, E. I. du Pont de Nemours & Co. (Inc.), Wilmington 98, Delaware.

U. S. PAT. OFF.

Du Pont "Cordura" High Tenacity Rayon

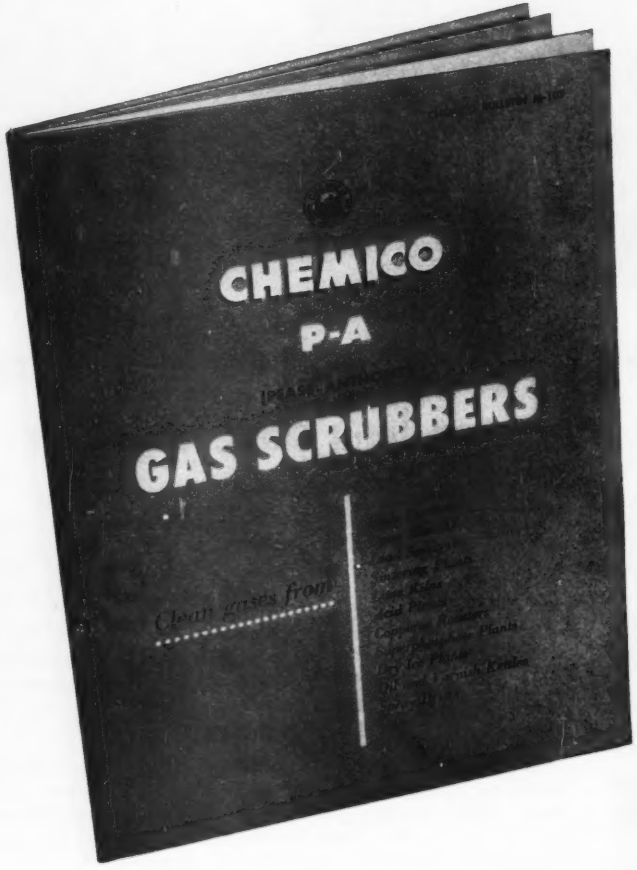
STRENGTH AT LOW COST

DU PONT

REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING ... *THROUGH CHEMISTRY*

High Gas Scrubbing Efficiency
AT LOW COST!



This Chemico bulletin contains factual information on the two types of Chemico P-A Gas Scrubbers. Both scrubbers offer high collection efficiency at low cost. Both are now being successfully used in a wide range of industries.

The bulletin gives performance data on the *P-A Venturi Scrubber* that effectively and economically removes sub-micron dusts, fumes and mists from industrial gases, and the *P-A Cyclonic Scrubber* for the removal of micron-size dusts from gas streams. If you have a gas scrubbing problem, write us detailing your specific requirements.

CHEMICAL CONSTRUCTION CORPORATION

A UNIT OF AMERICAN CYANAMID COMPANY

488 MADISON AVENUE, NEW YORK 22, N. Y.

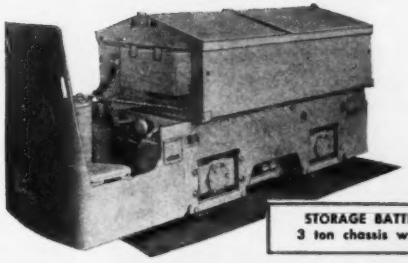
CABLES: CHEMICONST, NEW YORK

TECHNICAL REPRESENTATIVE IN EUROPE—CYANAMID PRODUCTS LTD., LONDON

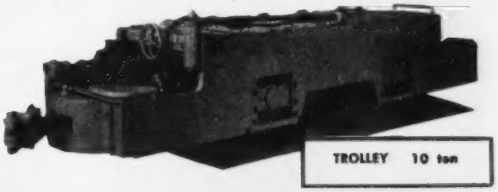
TECHNICAL REPRESENTATIVE IN SOUTHERN AFRICA—SOUTH AFRICA CYANAMID (PTY) LTD., JOHANNESBURG

Chemico plants are profitable investments

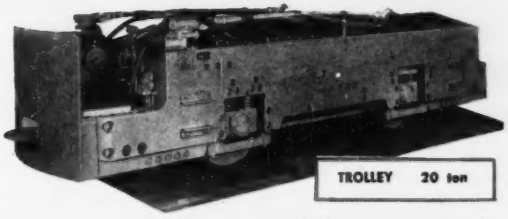
Goodman METAL MINE LOCOMOTIVES



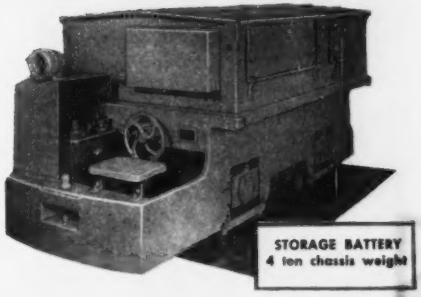
STORAGE BATTERY
3 ton chassis weight



TROLLEY 10 ton

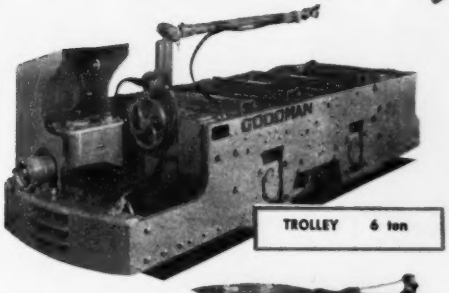


TROLLEY 20 ton

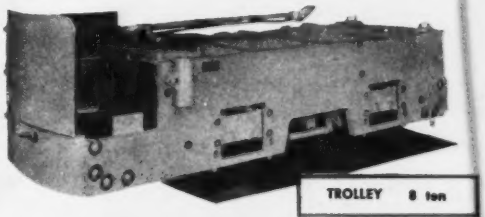


STORAGE BATTERY
4 ton chassis weight

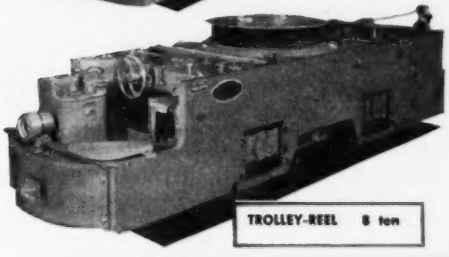
...all profitably in service



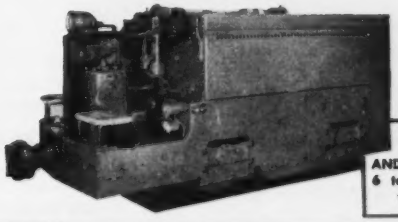
TROLLEY 6 ton



TROLLEY 8 ton



TROLLEY-REEL 8 ton



STORAGE BATTERY AND TROLLEY
6 ton chassis weight

There is a Goodman type of locomotive to fit any underground operation. Your inquiry is invited.

Goodman MANUFACTURING COMPANY
HALSTED STREET at 48th • CHICAGO 9, ILLINOIS

Builders of Coal Mine, Metal Mine and Tunneling Machinery For More Than Fifty Years

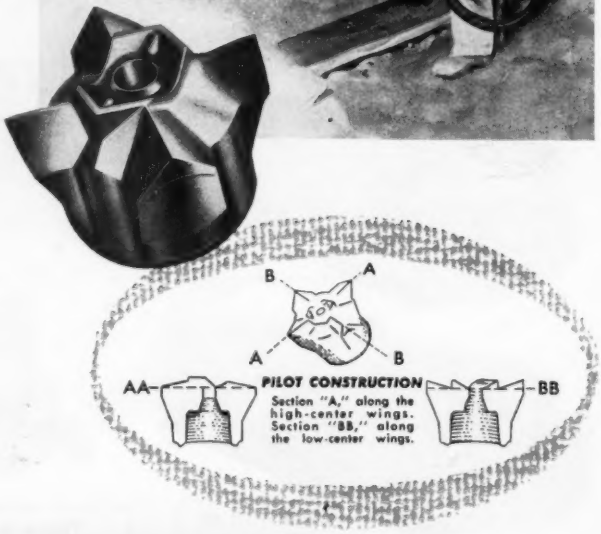
Chips off the old rock

Liddicoat bits actually *chip out the rock* instead of battering the rock until pulverized . . . as is the case with the ordinary conventional cross bit. This fast drilling factor is made possible because the Liddicoat detachable rock bit is used to destruction — no resharpening. Since resharpening is not involved it has been possible to design the bit for maximum drilling efficiency.

Lidddicoat's exclusive feature of the two-stage cutting action and the special wing design means that sharp cutting portions are retained for the life of the bit. The cutting edges are shaped for fast drilling and the reaming edges for long gauge life.

Many of the world's largest mining and contracting companies use Liddicoat because of its low initial cost, fast cutting performance and long cutting life . . . resulting in the lowest cost per foot of hole drilled.

Join this ever-expanding list of satisfied Liddicoat customers.



WESTERN
Rock Bit Manufacturing Company
552 West 7th South • Salt Lake City 4, Utah

"Every Little Bit Counts"

Using the RIGHT Wire Rope for the Job?

You'll get longer service life from wire rope if you do. Here are some points to keep in mind when you're selecting wire rope for any equipment . . .

STRENGTH

Don't send a boy to do a man's job. Make sure the wire rope you order has enough strength to take care of the maximum load—*plus* a necessary safety factor.

FLEXIBILITY

If your ropes undergo repeated bending over small sheaves, you'll need a flexible rope with maximum resistance to bending fatigue. Two things increase flexibility—smaller wires and preforming.

ABRASION RESISTANCE

Lang lay ropes, when properly installed, and constructions with large outer wires will help extend the service life of drag lines and other wire ropes that are subject to severe abrasive wear.

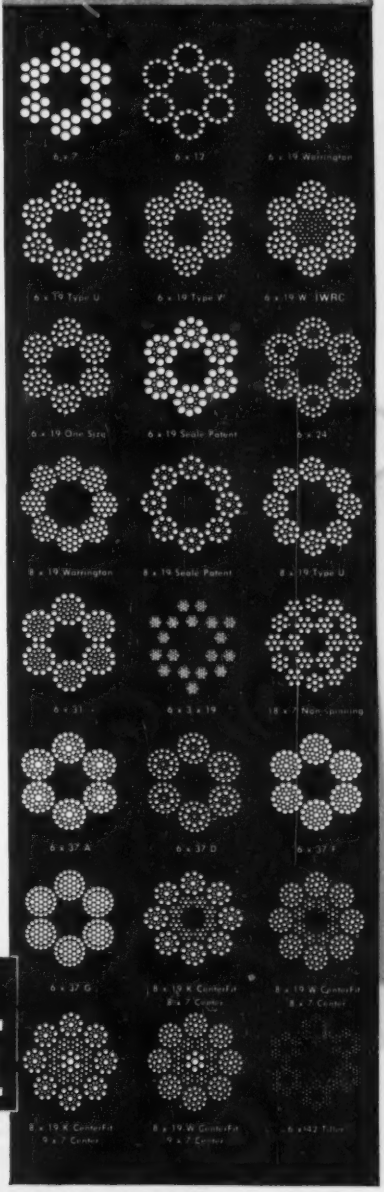
RESISTANCE TO CRUSHING

An independent wire rope center gives outside strands the support necessary to withstand crushing and distortion—large outer wires help spread the load over a greater area.

When you're looking for ways to cut operating costs, why not enlist the help of your nearest J&L Wire Rope representative? He'll help you select the *right* balance of these wire rope properties to get the longest service life on your specific type of equipment and operating condition.

Through years of research and actual operation in the field, J&L has developed a complete line of wire rope sizes and constructions. You'll find it profitable to cash in *NOW* on J&L experience and manufacturing know-how.

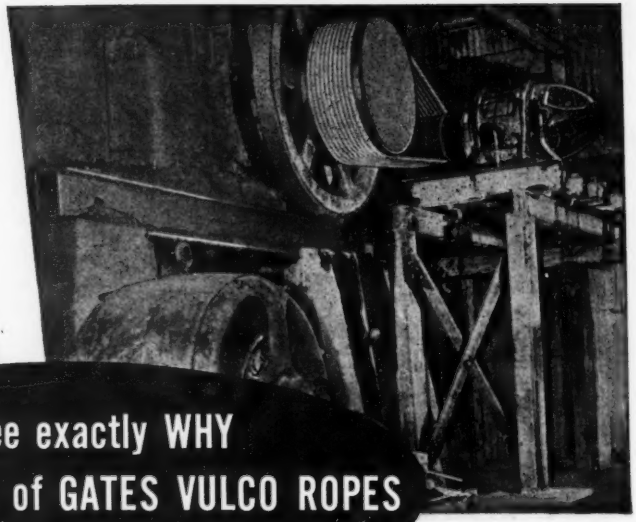
Select a Wire Rope that Fits Your Equipment Needs


6 x 7
6 x 12
6 x 19 Warrington
6 x 19 Type U
6 x 19 Type V
6 x 19 W IWRC
6 x 19 One Size
6 x 19 Seale Patent
6 x 24
8 x 19 Warrington
8 x 19 Seale Patent
8 x 19 Type U
6 x 31
6 x 3 x 19
18 x 7 Non-spinning
6 x 37 A
6 x 37 D
6 x 37 F
6 x 37 G
8 x 19 K CenterFit 8 x 7 Center
8 x 19 W CenterFit 8 x 7 Center
8 x 19 K CenterFit 9 x 7 Center
8 x 19 W CenterFit 9 x 7 Center
6 x 42 Tiller

J&L STEEL

JONES & LAUGHLIN STEEL CORPORATION

401 Jones & Laughlin Building • Pittsburgh 30, Pennsylvania



A large jaw crusher at the mill of a big copper mine in Sonora, Mexico, is driven by Gates Vulco Ropes. Picture shows the discarded motor still in foreground.

Let's see exactly WHY the Concave Sides of GATES VULCO ROPES mean lower V-Belt Costs!

Every engineer knows how a V-belt *changes shape* when it bends around a pulley.

The top of the belt is under tension—making it grow *narrower.*

The body is under *compression,* causing the sides to bulge out!

Look at figure 1-A in the diagrams, herewith. There you see how a *straight sided* V-belt is forced to bulge in its sheave-groove—and this bulging naturally causes extra wear along the middle of the sides as indicated by the arrows.

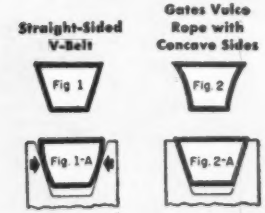
Now look at the figure 2-A. There you see how the precisely engineered Concave Sides fill out to an exact fit in the sheave groove.

Clearly, the Concave Sides press *evenly* against the V-pulley. This means uniform wear; longer life! The Concave Sides have *full traction;* wear longer because of *full contact!*

To sum up: The Concave Sides of Gates Vulco Ropes (U.S. Patent No. 1813698) give you (1) Less wear, (2) More pulley contact, (3) More sure power transmitted when needed!

Only V-belts made by Gates are built with concave sides. Whenever you buy V-Belts, be sure you get the V-Belt with the Concave Sides—The Gates Vulco Rope!

What Happens When a V-Belt Bends



How Straight-Sided V-Belt Bulges in Sheave-Groove. Sides Press Unevenly Against V-Pulley Causing Extra Wear At Point Shown by Arrows.

The Concave Sides Fill out to a Precise Fit in the Sheave Groove. No Side Bulge! Sides Press Evenly Against the V-Pulley—Uniform Wear—Longer Life!

CS-921

World's Largest Maker of V-Belts

Gates

Hose V-Belts Molded Rubber Goods for Industry

VULCO ROPE DRIVES

ENGINEERING OFFICES AND JOBBER STOCKS IN ALL INDUSTRIAL CENTERS

THE GATES RUBBER COMPANY • DENVER • U•S•A

TO MAKE CERTAIN you get the latest, most convenient and most accurate pH equipment, be *sure* to specify "BECKMAN" . . .

* Beckman pH equipment is completely electrometric, eliminating the mess and inaccuracies of colorimetric methods. Simply press a button and the exact pH of any process is instantly shown on a large easily-read dial. *It is the simplest of all pH methods!*

* With Beckman equipment no time-wasting or troublesome sampling devices are needed. Beckman pH electrodes may be installed directly in vats, tanks, channels or flow lines—and exact pH values read instantly—and *continuously*, if desired—on the process fluids themselves.

* The accuracy of Beckman pH readings is completely unaffected by human errors in color judgment, by turbidity, oxidizing or reducing agents, by suspended materials, colored process solutions or other variables that affect outmoded colorimetric methods. *Beckman pH readings are universally accurate and dependable!*

* Unique rugged-type Beckman Electrodes, especially designed for direct immersion in abrasive or suspension-laden fluids, reduce maintenance to an absolute minimum. *Beckman is the most trouble-free of all pH equipment!*

The above are only a few of many Beckman advantages. Write for the complete story.

WHETHER you are building a new plant or modernizing present equipment, one of the most important advancements you can make is the installation of BECKMAN pH CONTROL. Throughout the mining industry—in gold, tin, tungsten, lead, zinc, copper and many other flotation operations—Beckman pH Control is proving to be the key to much higher recoveries, better control of processes, lower labor and chemical costs. Result—substantially greater profits per ton of ore. Some of the many benefits resulting from Beckman pH Control include . . .

- greater speed, convenience and accuracy in laboratory leaching or flotation tests.
- opportunity for centralized or automatic, control of multiple flotation circuits.
- reduction of corrosion and scaling in pipe lines.
- improved or automatic, control of electrolytic operations.
- *and many other vital savings in mining and mill operations—savings that will quickly pay for the installation, and will continue producing extra profits year after year!*

Write for full details.

There's a Beckman pH Instrument to meet your needs!

COMPLETELY AUTOMATIC! The Beckman Model R instrument operates directly from standard 110 v. A.C. lines to provide completely automatic pH indication. Also provides for completely automatic pH recording and automatic process control. Can be installed to give accurate pH readings from various stations in plant through one instrument. *This is the pH unit being installed by today's most modern plants, large and small.*

PORTABLE A.C. OPERATION! The Beckman Model H instrument can be quickly moved from one part of the plant to another and plugs directly into standard 110 v A.C. current. Compact, convenient and extremely simple to operate, the Model H gives *instant* pH readings on an easily-read dial. Widely used both for manual pH control of small plants and as an auxiliary instrument on completely automatic pH installations.

COMPLETELY SELF-CONTAINED! The Beckman Model N is the ideal instrument where *complete* portability is desired. Operating from its own self-contained, long-life power supply, the Model N can be used *anywhere*—in plant, field or laboratory—without dependence on A.C. power circuits. Features maximum compactness, simplicity and operating convenience, coupled with extreme ruggedness. Available in two types . . . the N-1 with separate Buffer, KCl solution and beaker . . . the N-2 with integral case for Buffer, KCl solution, beaker, thermometer, etc.

BRING YOUR pH PROBLEM TO US. Our trained engineers will gladly study your problem and recommend the equipment best suited to your particular requirements. No obligation, of course.

Write for literature on Beckman pH Equipment!

BECKMAN INSTRUMENTS INC

SOUTH PASADENA 27, CALIFORNIA

Factory Service Branches: Chicago • New York • Los Angeles

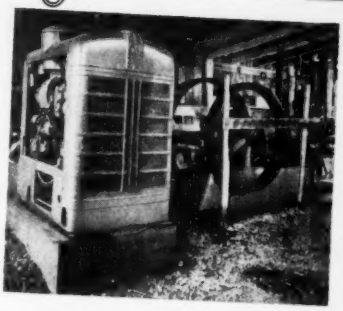
Beckman Instruments include: pH Meters and Electrodes—Spectrophotometers—Radioactivity Meters—Special Instruments

General Motors Diesel
Case History 5012-12

USER: United Feldspar Minerals Corp.
Spruce Pine, N. C.

INSTALLATION: 5-year-old GM 4-71 Diesel (used previously on sawmill) replaces steam engine on Ingersoll-Rand FR-1 compressor.

PERFORMANCE: Does as much work as 2 portable compressors with 4-cylinder gasoline engines and supplies more air. Maintains 100 lb. pressure for drilling. Cuts fuel costs 50%.



THIS DIESEL
does the work of two engines

Cuts fuel costs 50%—Supplies more air

Here's another typical case of how General Motors Diesels take over any job—stick to it month after month—and do it better than other gasoline or steam. After four years on a sawmill—and with one minor overhaul—this 4-71 is now outperforming two 4-cylinder gasoline engines and cutting fuel costs in half. Whatever your need for power—in air compressors, trucks, tractors, cranes or crushers—why not learn firsthand how much more profitably even a portable like the GM 2-cycle Diesel can deliver it? There's a GM Diesel distributor in your vicinity who'll gladly give you all the facts.

DETROIT DIESEL ENGINE DIVISION
GENERAL MOTORS, DETROIT 28, MICHIGAN

It pays to Standardize on

GM
GENERAL MOTORS
DIESEL POWER

Speed Up Loading with Dependable EIMCOS

Eimco 12B RockerShovel for small headings. Cages in 28"x44". Powerful, fast, dependable, efficient with exclusive safety features.

Eimcos do a better job in loading because they're actually top quality machines. They're powerful, efficient and rugged. The use of alloy steel castings and anti-friction bearings make them the most dependable loader on the market. Exclusive design features make them safe and free from troublesome gadgets—easy to operate.

The records of top mining companies and contractors show that Eimcos load at a lower cost per ton, are more reliable on the job and have a higher resale value.

Specification sheets are available on all Eimco RockerShovels. Write for them. Your friends in the mining or contracting business will tell you, "You can't beat an Eimco."

EIMCO

THE EIMCO CORPORATION

The World's Largest Manufacturers of Underground Rock Loading Machines

EXECUTIVE OFFICES AND FACTORIES — SALT LAKE CITY 10, UTAH, U. S. A.

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EL PASO, TEXAS, MILLS BUILDING • BERKELEY, CALIFORNIA, P. O. BOX 240
KELLOGG, IDAHO, 307 DIVISION ST. • LONDON W. 1, ENGLAND, 190 PICCADILLY

IN FRANCE, SOCIETE EIMCO, PARIS, FRANCE
IN ENGLAND, EIMCO (GREAT BRITAIN) LTD., LEEDS 12, ENGLAND
AGENTS IN ALL PRINCIPAL CITIES THROUGHOUT THE WORLD

A956

Aerial Exploration Helps the Mining Geologist in Two Ways

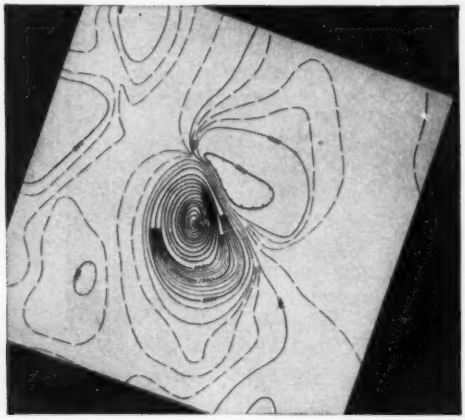
1

Provides photo-maps and detailed air photos which often yield important facts about surface geology and general trends. Useful, too, as base maps for all surface work.

Air photos like this one made from 35,000 feet are useful in geologic study and exploration planning.

2

Furnishes aerial magnetic data that is direct and positive. In the search for highly magnetic minerals, the airborne magnetometer almost says: "Dig here!" . . . and in nearly all cases gives useful structural information.



The Marmora anomaly is typical of the magnetic figure over magnetite bodies.

TODAY, footslogging *follows* aerial exploration. Now ground crews are directed to the most promising areas by the mapping camera and airborne magnetometer. By their use, difficult and expensive ground surveys are expanded in effectiveness and reduced in cost.

The Marmora find shown in the anomaly above is typical of the usefulness of aerial exploration. Another example is the delineation of the Allard Lake ilmenite deposits. Both are a part of our background experience.

Aero Service and its associate, Canadian Aero, have more exploration experience than anyone else. These companies have a background of over 300,000 miles of airborne magnetometer surveys, plus many miles of photo-mapping experience.

We have played a solid part in successful searches for iron, chrome, ilmenite, asbestos and titanium. Our broad experience can carry forward your exploration *at a fraction of the cost of ground surveys.* Write us.

TOPOGRAPHIC MAPS • PLANIMETRIC MAPS

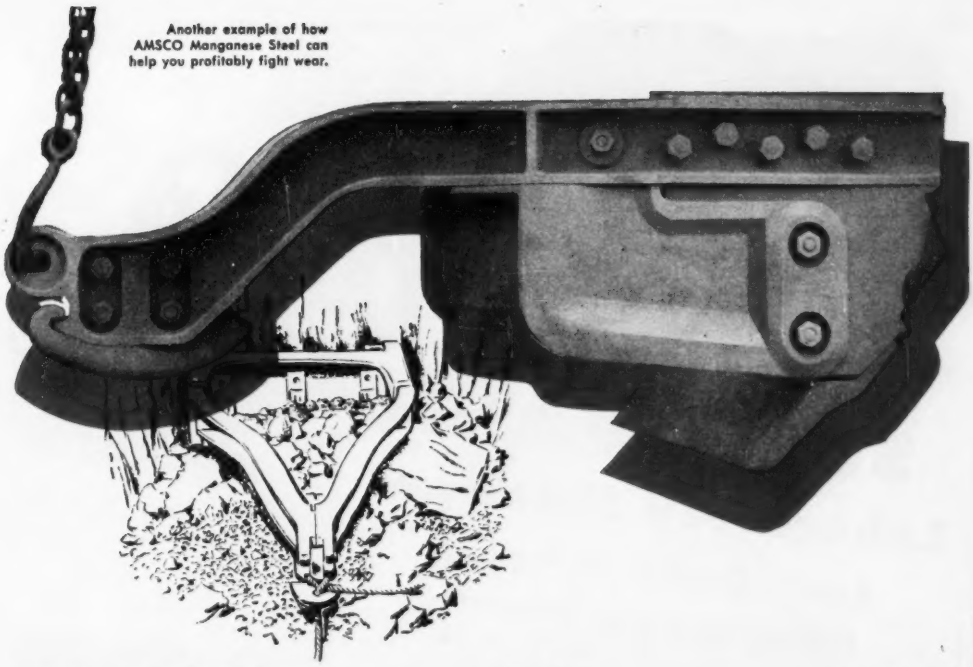
PRECISE AERIAL MOSAICS • AIRBORNE MAGNETOMETER SURVEYS

RELIEF MODELS • COLOR PHOTOGRAPHY

AERO
SERVICE CORPORATION
PHILADELPHIA 20, PENNSYLVANIA
Oldest Flying Corporation in the World

**In Canada, our affiliate is CANADIAN AERO SERVICE, LTD., 348 Queen Street, Ottawa, Ontario*

Another example of how AMSCO Manganese Steel can help you profitably fight wear.



This SCRAPER cut maintenance costs 20%!

How AMSCO Manganese Steel proved tougher than a tough mining problem

One of the toughest mining operations you'll find anywhere—tough from the standpoint of how it punishes equipment—is scraping heavy, corrosive pyrite ore. For example, a California mine has a deposit of 98% pure pyrite—with a specific gravity of 4.8. Impacts and abrasion caused by this ore were making short work of the scrapers previously used . . . on the average they needed major repairs over 4 times per year.

Several years ago two scrapers of the type shown above, which are sold exclusively by Joy Manufacturing Co., were put in service. They were made entirely of AMSCO Manganese Steel, and since then they've mined *over 220,000 tons of pyrite ore — and they're still in excellent condition!* These scrapers are repaired only once a year; simple repairs involving relipping and hardfacing of wearing surfaces.

Obviously, not all mining or excavating operations are as equipment-punishing as this one . . . *but the moral is clear* . . .

WHEREVER YOU MEET A PROBLEM OF WEAR CAUSED BY IMPACT AND/OR ABRASION . . .

. . . find out about longer-lasting, dollar-saving Manganese Steel made by AMSCO . . . world's largest producer of Manganese Steel castings for all industry.

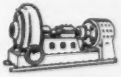
AMSCO controls impact and abrasive wear in 5 basic industrial operations:

Power Transmission

Mining and Excavating

Transportation

Crushing and Pulverizing

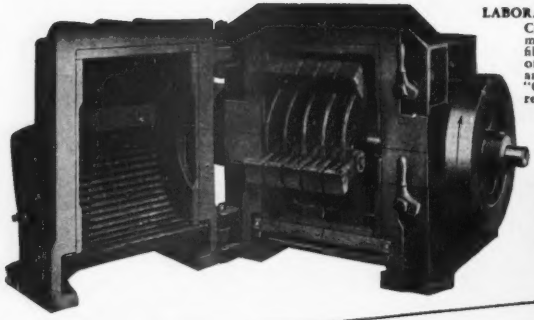


Materials Handling

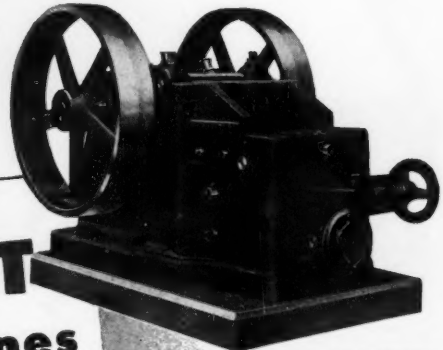
Brake Shoe AMERICAN MANGANESE STEEL DIVISION

376 EAST 14th STREET • CHICAGO HEIGHTS, ILL.

Other Plants: New Castle, Del., Denver, Oakland, Cal., Los Angeles, St. Louis. In Canada: Joliette Steel Division, Joliette, Que. Amsco Welding Products distributed in Canada by Canadian Liquid Air Co., Ltd.

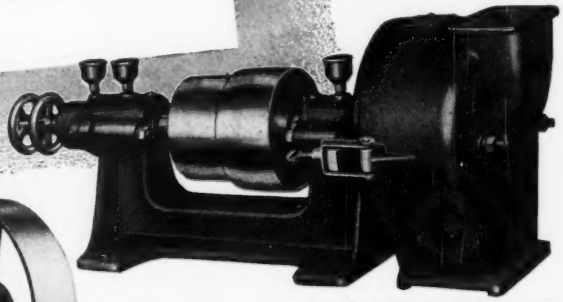


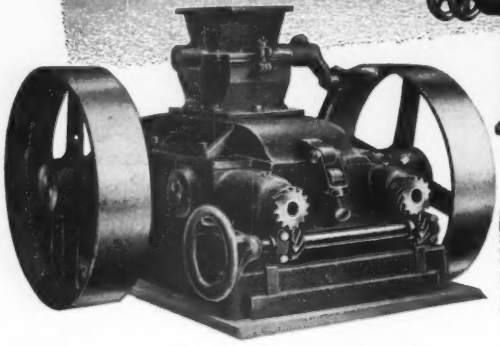
LABORATORY SWING-SLEDGE MILLS
Capable of reducing soft, moderately hard and tough or fibrous materials to any degree of fineness between 1 in. and 20 mesh. The patented "Open-Door" feature permits ready accessibility for cleaning.



STURTEVANT
Laboratory Machines
Assure Quality of Products
Fast - Economical - Accurate

LABORATORY JAW CRUSHERS
Special Roll Jaw action simplifies close regulation of the product with capacities varying from 300 or 400 lbs. per hour at finest settings, to 1000 or 2000 lbs. when opened for coarser work. Each part of the crusher is accessible for quick and easy cleaning.





LABORATORY CRUSHING ROLLS
First designed especially for laboratory sampling work, Sturtevant Crushing Rolls are used regularly in many plants where there are limited outputs. Range of output for the 8 x 5 size is from ½ in. to 20 mesh — and for the 12 x 12 size from ¾ in. to 20 mesh.

LABORATORY SAMPLE GRINDER
Laboratory Sample Grinders are of the "Open-Door" disc type and are capable of very fine work, producing products as fine as 100 mesh (coarser if desired) when working on dry, friable, soft or moderately hard materials. Simply turn hand wheel to provide product regulation from 10 to 100 mesh.

The only sure way to maintain strict quality of products is laboratory control . . . and that calls for accurate sampling.

Sturtevant Laboratory Equipment meets the exacting requirements of laboratory work. They are fast and accurate . . . provide true samples.

Rugged and dependable, Sturtevant equipment actually has all the features of full size machines plus extra accuracy and wider range of adjustment. The "Open-Door" accessibility permits quick, thorough cleaning . . . prevents the possibility of previous batches from contaminating new samples.

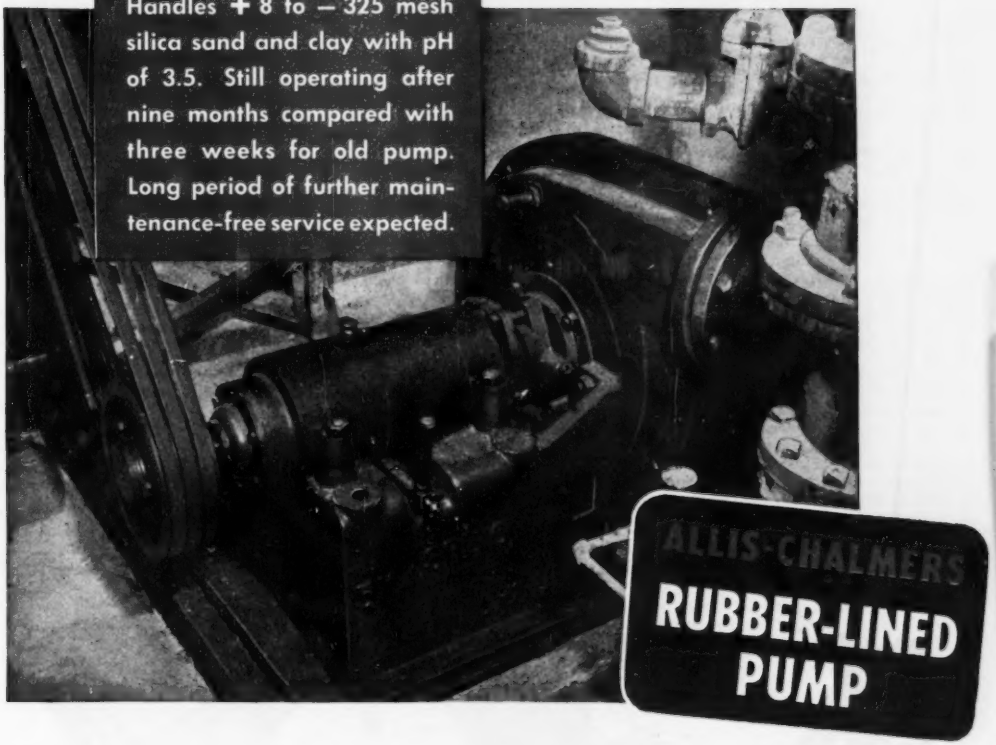
Investigate Sturtevant equipment for your laboratory. It will cut your sampling costs . . . help maintain strict quality of products . . . increase sales. Write for complete details and catalog.

STURTEVANT MILL COMPANY
101 CLAYTON STREET, BOSTON 22, MASS.

Designers and Manufacturers of: CRUSHERS • GRINDERS • SEPARATORS • CONVEYORS • MECHANICAL DENS and EXCAVATORS • ELEVATORS •

13 TIMES LONGER LIFE

—THAN PREVIOUS PUMP!


Handles + 8 to – 325 mesh silica sand and clay with pH of 3.5. Still operating after nine months compared with three weeks for old pump. Long period of further maintenance-free service expected.
ALLIS-CHALMERS
RUBBER-LINED PUMP

PUMPING WASTE FROM degritting operations in a Georgia clay pit wore out a high grade alloy pump every three weeks. This Allis-Chalmers SRL Rubber Lined Pump has been in operation over nine months without requiring any maintenance due to wear. And wear is so slight that no estimate can be made of its eventual useful life.

Such reliability and long wear make any pumping operation more profitable and are particularly important in 24 hour, 7 day operations like this one. Up to 50 times the wear life of the highest grade alloy pumps is not uncommon where the Allis-Chalmers Rubber Lined Pump has been used to pump fine abrasive suspensions.

SPECIAL RUBBER COMPOUNDS

Rubber lining compounds are especially engineered for each application. Linings are bonded to separate steel frames and not to the pump body, so they may be replaced without removing the pump from its location. The impeller is equally easy to remove and replace.

If you are pumping fine mesh, hard, abrasive materials (⅛" to 325 mesh size), find out how much more life you will get from an Allis-Chalmers Rubber Lined Pump and how it will reduce your cost per gallon pumped on tough operations. Ask your nearby Allis-Chalmers District Office representative, or write Allis-Chalmers, Milwaukee 1, Wisconsin and ask for Bulletin 08B7311.

A-3536

ALLIS-CHALMERS

If you want peak production

U·S·S COR-TEN

U·S·S COR-TEN is a ductile, low-carbon chromium-nickel-silicon-copper-phosphorus steel having a minimum yield point, in thickness of ½" and under, of 50,000 psi—at least one and one-half times that of structural carbon steel.

It has a minimum tensile strength of 70,000 psi in these same thicknesses. Its resistance to abrasion, shock and impact is superior to structural carbon steel; its fatigue resistance — that is, its ability to withstand vibration stresses, is 60% greater.

What particularly distinguishes **U·S·S COR-TEN** is its unusually high resistance to atmospheric corrosion—4 to 6 times that of plain steel, 2 to 3 times that of copper steel. It is this property that helps to assure the safety, long life and low maintenance cost of any equipment in which **COR-TEN** is used to obtain greater durability, or in lighter thicknesses to reduce weight.

U·S·S COR-TEN is produced in all standard products — plates, shapes, bars, sheets, strip, special cold formed sections, wire and tubular products. It is recommended particularly in light and intermediate thicknesses.

U·S·S MAN-TEN

U·S·S MAN-TEN is a grade of manganese-copper steel possessing formability, toughness and weldability in a higher degree than obtainable in carbon steel of the same strength level.

U·S·S MAN-TEN has the high yield point and high tensile strength of 50,000 psi and 75,000 psi, respectively, in thicknesses up to ½" inclusive. Its abrasion resistance is greater than that of structural carbon steel (ASTM A7); its fatigue strength is approximately 40% higher, insuring greater resistance to the vibration and reversal of stresses to which many types of equipment are subjected.

U·S·S MAN-TEN is well suited for applications requiring high strength, toughness, workability and weldability together with atmospheric corrosion resistance equal or slightly better than that of copper steel. More than 16 years of satisfactory service under the most severe conditions have established the suitability of this grade for lightweight, rugged construction.

U·S·S MAN-TEN is produced in plates, shapes, bars, sheets, strip, special cold formed sections and other products. It is particularly recommended for light and intermediate thicknesses.

from your equipment

Give it the stamina to stay on the job

U·S·S TRI-TEN

This manganese-nickel-copper steel has a yield point of 50,000 psi min. and a tensile strength of 70,000 psi min. in thicknesses ½" and under, with moderately lower values as thickness increases to a maximum of 4". It has superior toughness and ability to withstand shock at sub-zero temperatures. It has greater resistance to abrasion than structural carbon steel (ASTM A7) and its fatigue resistance is 50% higher. **U·S·S TRI-TEN'S** resistance to atmospheric corrosion is slightly superior to copper steel.

Because **U·S·S TRI-TEN** has very good welding properties in intermediate and heavier thicknesses, this grade is particularly recommended for application in heavy duty equipment, such as illustrated below, where maximum ruggedness and strength with minimum weight are prime requisites.

U·S·S TRI-TEN is produced in plates, structural shapes, bars and bar shapes.

YOU can do it with U·S·S High Strength Steels.

Today the mining industry faces the biggest task in its history. To meet the nation's critical mineral requirements it must produce as never before.

Big-capacity, faster and more powerful equipment will help you meet this situation. But *only* if it is rugged enough to take a record amount of punishment, *only* if it can stand up in any kind of weather—day after day.

That's why it is so important to minimize, as far as possible, structural failures that can put costly, urgently needed equipment out of service. That's why it is vitally necessary to make sure that your drag lines, shovels, crawlers, 'dozers, trucks, mine cars, and other essential equipment are built as strong, as tough and as durable as possible.

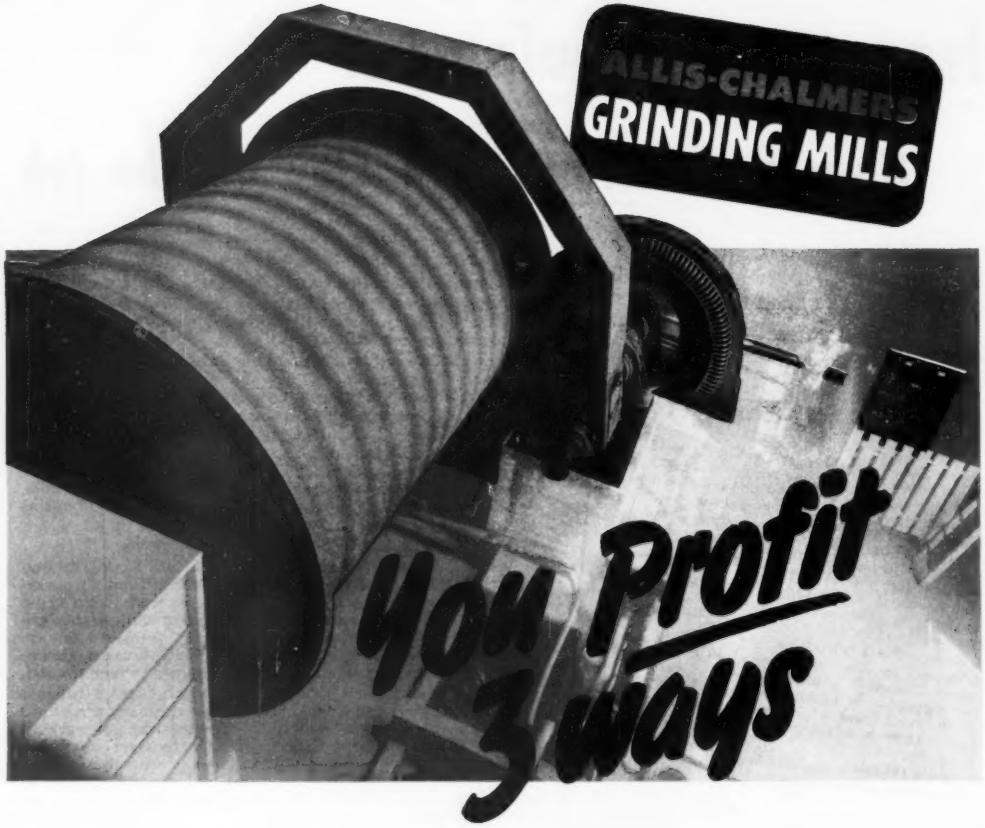
You can do it with U·S·S High Strength Steels.

With high-strength U·S·S COR-TEN, U·S·S MAN-TEN and U·S·S TRI-TEN, equipment breakdowns that hamper operations and run up costs can be greatly reduced. With these famous "steels that do more" you can build maximum strength and toughness into vital parts ordinarily prone to failure. With them, high resistance to wear, fatigue, abrasion, atmospheric corrosion and shock can be incorporated where needed.

In addition, these U·S·S High Strength Steels—because they have a yield point 50% higher than ordinary structural steel—can be used to materially increase the strength of parts without increasing their weight. Or they can sometimes be used in lighter sections without in any way diminishing strength or stamina. In both cases, substantial savings in steel may result. This is important now, with steel in restricted supply.

Our engineers for 16 years have cooperated with the mining industry in applying U·S·S High Strength Steels to equipment noted for its dependability, long life and low maintenance cost. They will be glad to show you how these tougher, stronger, more durable steels can be applied to give your equipment the stamina to stay on the job.

AMERICAN STEEL & WIRE .... COLUMBIA-GENEVA STEEL .... NATIONAL TUBE .... TENNESSEE COAL & IRON
UNITED STATES STEEL SUPPLY, WAREHOUSE DISTRIBUTORS .... Divisions of **UNITED STATES STEEL COMPANY, PITTSBURGH**
UNITED STATES STEEL EXPORT COMPANY, NEW YORK



...WHEN YOU SPECIFY ALLIS-CHALMERS GRINDING MILLS

1 **YOU CAN BE SURE** of getting a grinding mill specifically suited to your requirements. A wide range and multiple combinations of types and sizes assures this . . . assures top, economical performance year in, year out.

2 **YOU GAIN** the seasoned benefits and *unequalled* experience accumulated through the successful installation of more than 4200 Allis-Chalmers mills over a period of 70 years.

3 **YOU ARE DOUBLY ASSURED** of completely balanced operation, with its resulting economies, when you equip your mills with motors, drives and controls — all manufactured in A-C shops.

NEW 44-page grinding mill bulletin 07B6718A is chuck full of valuable tables and grinding mill information. Get it from A-C representative in your area or write Allis-Chalmers, Milwaukee 1, Wis. A-3563

Pulverator is an Allis-Chalmers trademark.

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Sales Offices in Principal Cities in the U. S. A. Distributors Throughout the World.

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Vibrating Screens

Kilns, Coolers, Dryers

Keep 'em Moving

DIAGRAMMATIC SKETCH OF
EXCLUSIVE ROTOCURE PROCESS

—that's how ROTOCURE prevents OCS*—Achilles Heel of Conventional Belts!

"Start and stop" vulcanization (the conventional flat press method) can bump conveyor belt costs way out of line due to short life and constant replacements. Here's why: Press overlaps are *unavoidable* in this method of belt manufacture. They *result in overcured segments that weaken the belt.*

Why Rotocure-made Belts Are Superior to Flat Press

The BWH—pioneered method of ROTOCURE is a continuous, endless curing process of uniform belt advancement. Every inch of the belt is subjected to *identical* curing—in amount and in time. Thus weak segments due to overlapping are eliminated automatically by the process itself.

Why Rotocured Belts Should be on Your Jobs

The weak segments you *don't get* in BWH conveyor belts mean you *do get:*

1. Increased belt flex life—up to 40%.
2. Elimination of mechanical distortion at the press ends.
3. Constant, uniform stretch.
4. Uniform, abrasion-resistant covers.

For years, it's been an established fact among users that BWH Rotocured belts are "tonnage producers." If *you* want longer belt life, a good size dip in belt maintenance costs and savings per ton in materials conveyed ask your BWH distributor. He *knows* who's buying the values! Or write us direct.

*Overcured Sections-present every 30' to 40' in all belts made by the flat press method. Only Rotocuring (continuous, non-stop curing) eliminates this major cause of belt failures.

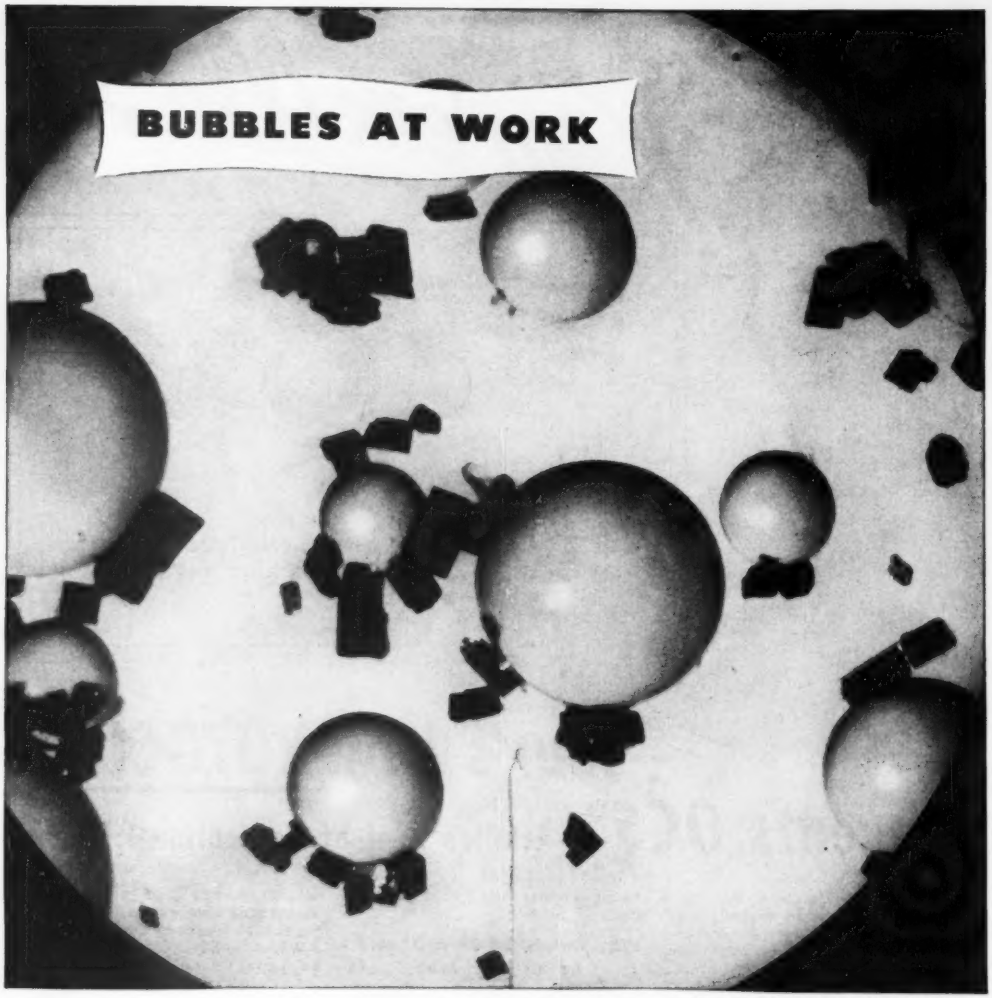
BWH
DEPENDABLE RUGGEDNESS

Another Quality Product of

BOSTON WOVEN HOSE & RUBBER COMPANY

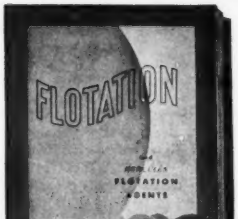
Warehouse Stock: 111 N. Canal St., Chicago, Illinois **Distributors in all Principal Cities**

PLANT: CAMBRIDGE, MASS. • P. O. BOX 1071, BOSTON 3, MASS., U. S. A.



Photomicrograph, greatly enlarged, by H. Rush Spedden

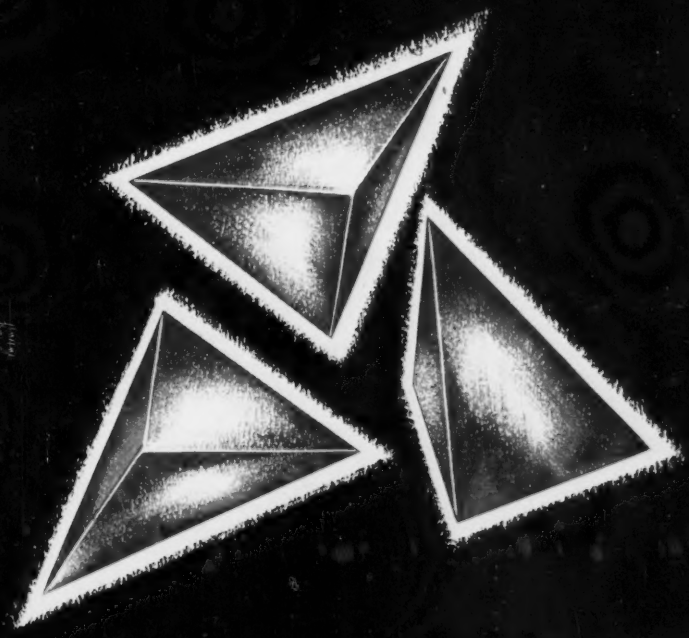
To help step-up flotation recoveries at low cost, Hercules has developed a number of frothers and collectors. Yarmor® F Pine Oil has been a standard of quality among pine oil frothers since the early 1920's. RADA (Hercules' Rosin Amine D Acetate) is a siliceous mineral collector that has good solubility and is easy to handle. It is used in the commercial flotation of several nonmetallic ores. These and other Hercules products are described in a 16-page technical booklet, "Flotation and Hercules Flotation Agents." This booklet also contains many formulas useful in the operation and control of modern ore-dressing mills. *Send for your copy.*



HERCULES POWDER COMPANY 933 King St., Wilmington, Delaware

HERCULES Flotation Agents

NM51-1



ATOMIC SCIENTIST No. 1 DID US ALL A GOOD TURN

Nature, the original atomic scientist, created in the diamond one of her great masterpieces.

In finer industrial qualities the atoms are arranged in tetrahedral form and billions of them are compacted in even the tiniest diamond crystal. They form the hardest substance known to man, long prized as the supreme cutting medium.

Other diamond structures are often agglomerate; a sort of mineral pudding of diamond atoms in various crystalline arrangements, excellent in many applications but without the peculiar atomic structure which gives the selected diamond its incomparable cutting power.

The diamonds used in Truco diamond drill bits have always been selected with due observance of their individual characteristics—and set with their "best side toward the work."

Their superior performance in the field follows as a matter of simple logic.

WHEEL TRUEING TOOL COMPANY

3200 W. DAVISON AVENUE, DETROIT 6, MICHIGAN

WHEEL TRUEING TOOL CO. OF CANADA, LTD.

573 LANGLOIS AVENUE, WINDSOR, ONTARIO, CANADA

When more steel means more production . . .

that Pioneer Edge

How Wacootah Mine was kept in operation

With the supply of choice ore exhausted at its Wacootah Mine, Wheeling Steel Corporation was faced with the alternative of abandoning the operation or finding efficient means for handling and concentrating low grade ore. The crushing, screening and washing plant shown here provided the solution.

Delivered by truck, the material is ingeniously routed by sturdy Pioneer feeders and conveyors thru a Pioneer scalping screen, jaw crusher, washing screen, and classifier. The result is a high grade concentrate, economically produced and ready for market.

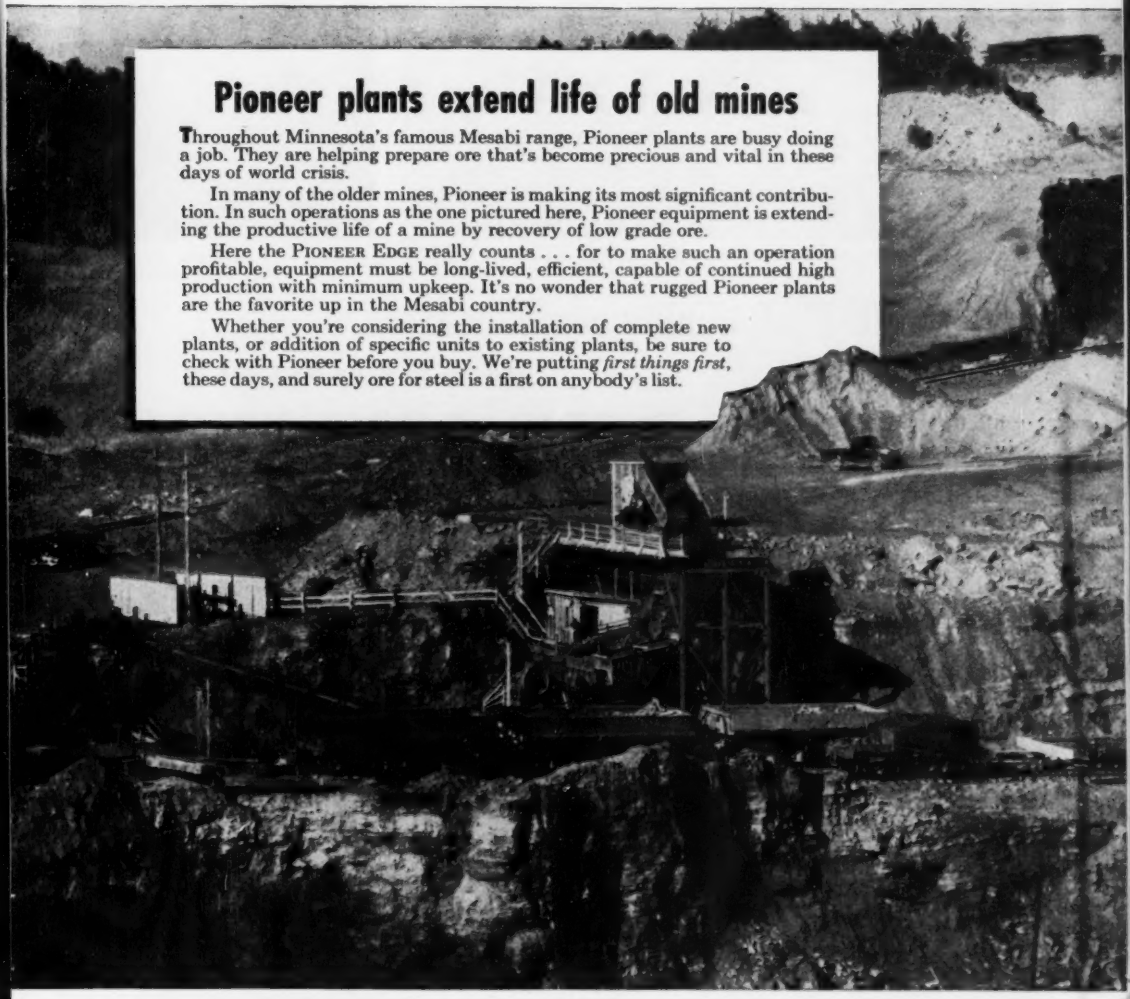
This plant, near Mountain Iron, Minnesota, consistently exceeds its rated capacity of 100 tons per hour. It is but one of the many successful Pioneer installations operating on the Mesabi and Cayuna Ranges.

BUY BOTH!
HIGHER OUTPUT
LOWER UPKEEP

Pioneer

Continuflo EQUIPMENT

keeps iron ore flowing



Pioneer plants extend life of old mines

Throughout Minnesota's famous Mesabi range, Pioneer plants are busy doing a job. They are helping prepare ore that's become precious and vital in these days of world crisis.

In many of the older mines, Pioneer is making its most significant contribution. In such operations as the one pictured here, Pioneer equipment is extending the productive life of a mine by recovery of low grade ore.

Here the PIONEER EDGE really counts . . . for to make such an operation profitable, equipment must be long-lived, efficient, capable of continued high production with minimum upkeep. It's no wonder that rugged Pioneer plants are the favorite up in the Mesabi country.

Whether you're considering the installation of complete new plants, or addition of specific units to existing plants, be sure to check with Pioneer before you buy. We're putting *first things first*, these days, and surely ore for steel is a first on anybody's list.

***These units give* WHEELING STEEL *that* Pioneer Edge AT WACOOTAH**

- 48" x 12'3" Manganese Steel Feeder
- 4' x 10' Mesabi Scalping Screen
- 36" x 14' Rock Reject Apron Feeder
- 30" x 12' Apron Feeder Under Scalping Screen
- 30" x 42" Jaw Crusher
- 5' x 12' Mesabi Double Deck Washing Screen
- 24" x 105' Super Service Conveyor
- 24" x 130' Super Service Conveyor

In addition, there are a 1000 G.P.M. Tailings Pump, a 36" x 19'3" Classifier and a 90 tons capacity track loading pocket.

PIONEER ENGINEERING WORKS
1515 Central Avenue • Minneapolis 13, Minnesota
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● Please send me information on the equipment checked.

- ☐ MANGANESE STEEL FEEDERS
- ☐ FORGED STEEL APRON FEEDERS
- ☐ JAW CRUSHERS
- ☐ ROLL CRUSHERS
- ☐ VIBRATING SCREENS
- ☐ LONG CONVEYORS
- ☐ PORTABLE CONVEYORS
- ☐ ORE WASHING PLANTS
- ☐ SEND ME COMPLETE DETAILS OF OPERATION OF THE PLANT FEATURED IN THIS ADVERTISEMENT.

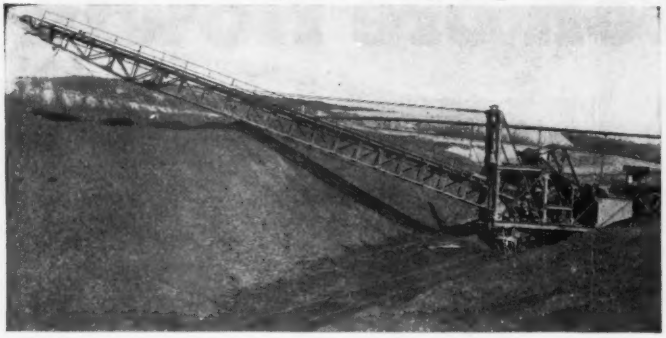
*Name*_____

*Company*_____

*Address*_____

*City*_____ *Zone*____ *State*_____

LINK-BELT engineering experience...

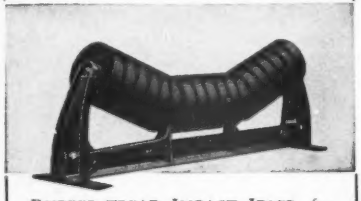


Link-Belt belt conveyor system with 100-foot radius traveling stacker and 500-foot trailing section, for stockpiling minus 1½-inch washed iron ore at 400 tons per hour.

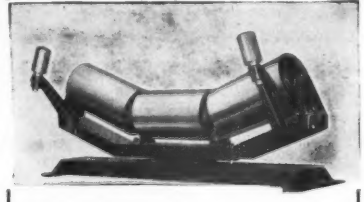
Belt conveyor collecting ore concentrate from rotary table feeders.

Plus LINK-BELT quality components...

SERIES 100 TROUGHED BELT IDLERS. Strong, balanced integral rolls revolve on high-grade roller bearings, Grease-in, dirt-out seal, large reservoir preserve lubricant.



RUBBER-TREAD IMPACT IDLER for loading points protects the belt by absorbing the shock of heavy materials or lumps delivered from above.



BELT-TRAINING IDLER for automatic belt positioning. The actuating rolls respond to slightest contact — quickly recede and center the belt to minimize wear.

...add up to your best bet in

BELT CONVEYORS

WHAT'S your materials handling problem? Tonnage, distance or a combination of the two? Heavy or light materials? Large lumps or fines? Continuous or intermittent operation?

Whatever the conditions, you'll find the right answers at Link-Belt. For Link-Belt designs conveyor systems to meet your requirements. Backed by unmatched materials handling and power transmission experience, our conveyor specialists help you and your consultants get the right equipment in the right place.

One Source—One Responsibility

Link-Belt makes all the various elements — all types and sizes of idlers, takeups, pulleys, trippers, bearings and power transmission drives. Plus all related equipment — other types of conveyors, feeders, elevators, car dumpers and shakers.

And Link-Belt will build your supporting structures and enclosures . . . install the job completely. One source — one responsibility. Every detail receives the proper attention to assure you an efficient, trouble-free, long-life conveying system.

The next time you need belt conveyor engineering assistance, call the Link-Belt specialist in our office near you.

LINK-BELT

BELT CONVEYOR EQUIPMENT

LINK-BELT COMPANY: Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Springs (South Africa). Offices in principal cities. 12,800-A

BUILD PROFITIME...CUT DOWNTIME-

with **Firestone**
OFF-THE-HIGHWAY TIRES

THAT's right! You increase yardage and profits and reduce operating cost when your equipment rolls on Firestone. That's just what the Firestone Earth Mover All Non-Skid tires are doing in the illustration above. This tire is engineered and built for free-rolling wheels — for scrapers, wagons, and buggies — equipment on which maximum flotation, frictional traction, and low rolling resistance are essential. And it holds on slopes without side-slipping.

Firestone Tires stand up longer because they are *built for the job and they are built to take it.* Extra tough, heavy treads give more traction under all conditions. Gum-Dipped rayon cord bodies are reinforced with four extra impact plies and can be retreaded again and again. Tough sidewalls are double-thick and snag-resistant.

Whether it's earth moving, strip mining or rock work, Firestone has the tires and the service that will cut downtime and keep men and equipment on the job. Try them and see for yourself.

WHEN YOU BUY NEW EQUIPMENT OR REPLACEMENT TIRES, SPECIFY FIRESTONE

Enjoy the Voice of Firestone on radio or television every Monday evening over NBC

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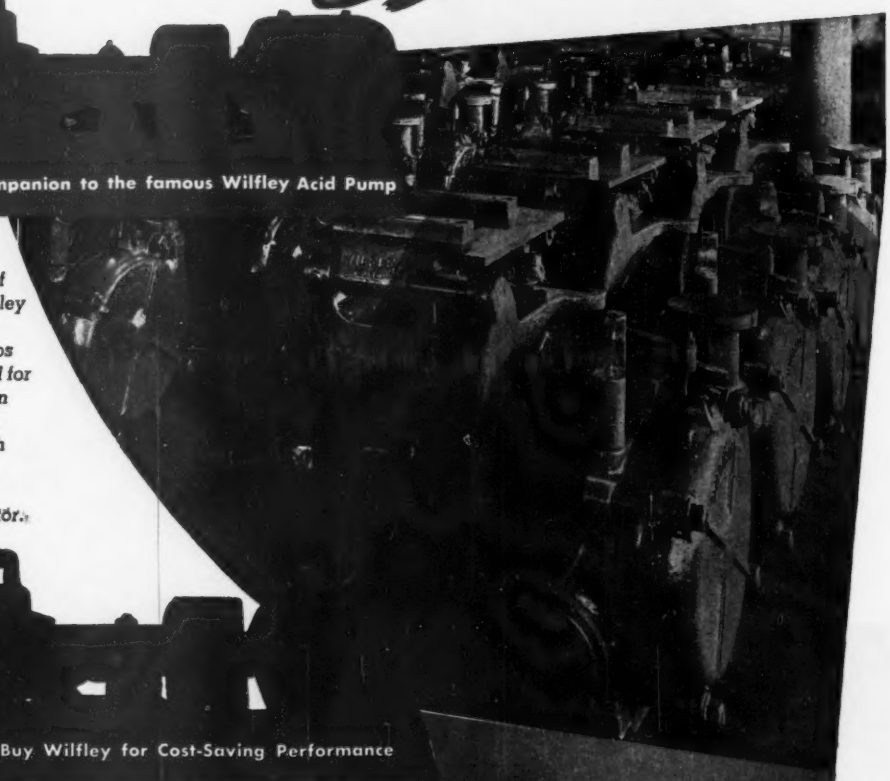
WILFLEY *Sand* PUMPS

Companion to the famous Wilfley Acid Pump



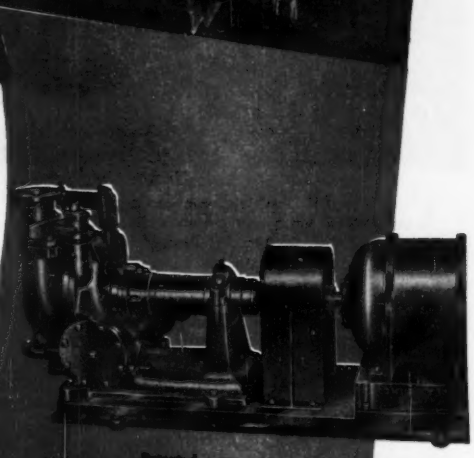
Part of a shipment of 5-inch Wilfley Model "K" Sand Pumps engineered for the flotation circuit of a large South American Copper Concentrator.

Buy Wilfley for Cost-Saving Performance

The new Model "K" Wilfley Sand Pump has won the approval of engineers throughout the world because of its dependable, trouble-free performance. Important improvements embodied in the Model "K" produce higher efficiencies, lower operating costs, worthwhile power savings, and stepped up production. Easy interchangeability of wear parts. Low maintenance costs. Individual engineering on every application.

Catalog 200 shows sizes, construction and application of Wilfley Model "K" Sand Pumps.

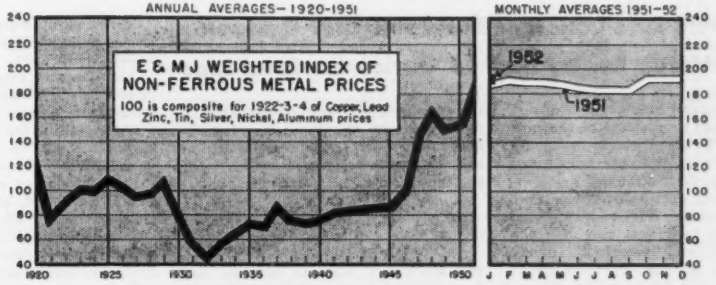
Write or wire for your copy today.



A. R. WILFLEY & SONS, INC. DENVER, COLORADO, U.S.A. • NEW YORK OFFICE: 1775 BROADWAY, NEW YORK CITY

E&MJ OUTLOOK

PRICES



MARKETS

The deadlock over the tin price broke when the Truman-Churchill agreement set a selling basis of $1.18 per lb., f.o.b. Singapore for 20,000 tons of Malayan tin for shipment to the U.S. On January 22, the RFC raised its New York quotation from $1.02 to $1.21½, tying the new price to the level of the Malayan tin deal. Bolivian producers will probably hold out for a still higher settling basis.

The *E&MJ* index of nonferrous metal prices advanced from 193.17 in December to 193.83 in January, reflecting the rise in tin.

Defense Mobilizer Wilson says there's going to be no increase in the domestic price of copper—period. This is aimed at getting the scrap dealers to give up waiting for a rise and come in with the scrap. If you were a scrap dealer, would you? Neither will they.

It's true, however, that foreign premium prices for lead and zinc are back about to domestic levels and copper is sagging. A sign of weakness in the copper market would bring out scrap fast.

•

LABOR

There'll be no Non-Ferrous Metals Commission in this "emergency," says the Wage Stabilization Board. This is a disappointment to Mine-Mill.

Flushed by recent favorable settlements, Mine-Mill is planning to win back some ground lost to other unions. First blow is a demand for a representation election in St. Joe's southeast Missouri operations.

•

AT HOME

The year ahead will set a record for industrial plant expansion. Investment in new enterprises for nonferrous metals will be up 60% over 1951. Industry generally will spend not only record amounts this year, but will carry on at a high level after 1952. It's good news for mining.

It looks as if stockpiling of lead will be resumed, the supply having eased sufficiently. Zinc is in an easier position; copper and the other metals will be tight for some time. The government says no easing in copper for years; but it might come even by the end of the year.

Even before the first nickel oxide comes out of the revived Nicaro Nickel plant in Cuba, the government wants to double its capacity. The men on the job would rather wait six months and see how it goes.

•

ABROAD

There's a copper-cobalt discovery at Kilembe in Uganda that is shaping up very well. The governments concerned are planning to build an $11-million railroad 200 mi. from Kampala to the site. Frobisher, Ltd. and Rio Tinto Co. Ltd. have it. Reserves are said to be 12-million tons running 1.95% copper and 0.2% cobalt.

Aluminium, Ltd., of Montreal, will put another $20-million into its Jamaica bauxite properties to raise output from 200 to 500 short tons of alumina per day. The company produces alumina on the spot; for details read the article on their plant in our next issue.

MARKETS—Trends and Prices

Consumers Less Concerned Over Supply Outlook—Senate Votes Suspension of Duties on Lead-Zinc

THOUGH DEFENSE OFFICIALS continued with their dire predictions of the coming squeeze in all strategic materials, buyers and sellers of nonferrous metals throughout January appeared less concerned over the outlook than in recent months. The supply situation in both lead and zinc has improved. Foreign "premium" prices continued to weaken, particularly in lead.

In the domestic market, the RFC had to reverse its stand on tin and raised the price 18½¢ per lb. to the basis of $1.21½, effective Jan. 22. This move followed soon after President Truman and Prime Minister Churchill announced that the British agreed to sell 20,000 long tons of tin to this country on the basis of $1.18 per lb., f.o.b. Singapore. Quicksilver sold at lower prices on increased offerings of so-called outside lots.

The *E&MJ* index of the nonferrous metal prices advanced to 193.83 for January, owing to the rise in tin. The index for December was 193.17 and for January a year ago 192.48.

Industrial production in the United States has been maintained at about the same level over the last four months. The government's program for curtailing production in the automobile industry has been reflected in a more cautious buying policy by parts-makers. Some die-casters are preparing to reduce their requirements.

Steel production continued at a record rate. The steel-making capacity of the country is now estimated at 108,587,670 tons, the highest ever. Capacity has increased 33% since 1940. During the final week of January, steel output was scheduled at 100.1% of capacity, equivalent to 2,079,000 tons for the seven-day period. This activity naturally calls for heavy tonnages of manganese, chrome and numerous alloying elements. Demand for nickel, cobalt, molybdenum and tungsten shows no signs of slackening.

No Price Change in Copper

The Office of Defense Mobilization will block any move to increase the domestic price of copper or copper scrap, Defense Mobilizer Wilson declared on Jan. 25. He made this statement to squelch a rumor to the effect that the price is to be raised to match foreign copper despite opposition of OPS. This leaves domestic copper at 24½¢ and foreign copper at 27½¢, except where outside foreign business is concerned. In the premium markets of Europe, prices ranging from 40¢ to 54½¢ per lb. have been paid. However, there were clear indications that buyers abroad are shying away from the extremely high prices.

The National Production Authority allocated 106,800 tons of refined copper to domestic fabricators for February. Of this quantity the brass mills are to get 46,583 tons, wire mills 50,872 tons, foundries 5,785 tons, and exporters 3,560 tons. Total allocations in January came to 120,000 tons.

Imports of copper in 1952 are expected to increase, providing there are no work stoppages. Canada has agreed to increase its exports of copper to the United States this year by 15,800 tons. Imports from Chile will increase.

Votes Duty Suspension

On the last day of the month the Senate passed by voice votes two House bills suspending the import duties on lead and zinc until March 31, 1953, with safeguards as to price. The measures were returned to the House for approval of several minor amendments.

The Senate amendment on lead raised the level at which the President is to revoke the suspension if the domestic price should fall before March 31, 1953 to 18¢. The floor set in the House measure was 16⅞¢.

In reference to slab zinc, the level at which the duty would be reinstated prior to March 31, 1953, is 18¢. An amendment to the House bill limits the suspensions on zinc to zinc-bearing ores and concentrates and slabs, blocks and pigs.

Suspension of the duties is assured and is expected to aid consumers materially in purchasing the metals and pricing their products under the controls now in force.

The supply outlook in lead has improved sufficiently to warrant serious consideration by NPA of a general easing of the controls. At a meeting

E & M J Index of Non-Ferrous Metal Prices

(100 is composite for 1922-3-4)

Year			1948	1949	1950	1951
1940	79.22	January	154.20	185.52	135.86	192.48
1941	83.49	February	155.63	185.75	135.65	194.06
1942	86.80	March	155.63	179.31	132.60	190.19
1943	88.74	April	160.67	160.86	134.04	190.18
1944	88.74	May	161.33	148.05	142.02	189.47
1945	90.86	June	162.30	131.20	154.30	187.19
1946	110.06	July	164.55	136.65	156.40	186.46
1947	149.46	August	177.68	141.90	160.67	186.15
1948	168.38	September	178.26	142.24	172.56	186.15
1949	151.97	October	179.58	137.81	179.83	193.21
1950	156.42	November	185.26	138.18	186.00	193.17
1951	190.16	December	185.52	136.18	187.05	193.17

Average Prices for January (E&MJ Quotations)

Copper:

Electrolytic, domestic, refinery	24.200
Electrolytic, export, refinery	27.425

Lead:

Common, New York	19.000
Common, St. Louis	18.800

Silver and Sterling Exchange:

Silver, New York, per oz.	88.000
Silver, London, pence per oz.	77.000
Sterling Exchange, "Checks"	278.034

Zinc:

Prime Western, East St. Louis	19.500

Tin:

New York Straits	109.404
New York, 99% min. (e)	108.404

Gold, per oz. U.S. price	$35.000
Quicksilver, per flask	$206.346
Antimony (E&MJ) (d)	53.350
Antimony, bulk, Laredo	50.000
Antimony, in cases, Laredo	50.500
Platinum, refined, per oz.	$90.000
Cadmium (a)	255.000
Cadmium (b)	267.500
Cadmium (c)	280.000
Aluminum, 99% plus, ingot	19.000
Magnesium, ingot	24.500
Nickel (f)	56.500

Domestic quotations, unless otherwise stated, are in cents per pound. Sterling exchange checks, in cents. Quicksilver, per flask of 76 lb.
(a) Cadmium average based on the producers' quotation.
(b) Cadmium average based on the average of the producers' and platers' quotation.
(c) Cadmium average based on platers' quotation.
(d) Domestic, 5 tons or more but less than carload lot, packed in cases, f.o.b. New York.
(e) Tin content.
(f) F.o.b. Port Colborne, U.S. duty included.

in Washington late in January representatives of the industry urged that allocation of foreign lead be ended immediately.

Tin shipments to this country under the British deal are scheduled to begin in March. Malaya is expected to export about 5,000 tons a quarter under the agreement to supply a total of 20,000 tons.

A decision to modify the air force program will result in a downward revision of current defense requirements in aluminum. This may release 35-million lb. for civilian needs in the second quarter.

"Free" Gold Market

The market for "free gold" was inactive during January and price movements were mixed. Prices named in the Far East were higher, whereas Paris was lower.

Quotations for "free gold," per fine oz., according to Pick's World Currency Report:

	Coins		Bars (12.5 kg.)	
	Dec. 30	Jan. 30	Dec. 30	Jan. 30
NEW YORK, transit	.....	.....	$39.00	$38.75
MANILA	$48.00	$49.50	39.83	41.75
HONG KONG	47.00	49.00	42.00	42.75
BOMBAY	54.00	55.00	48.00	49.50
TANGIER	53.50	50.50	39.00	38.85
BEYROUTH	50.50	50.50	38.83	39.00
PARIS	54.50	54.00	41.63	40.75
BUENOS AIRES	53.50	53.50	43.00	43.25

(Markets continued on page 134)

Major Metals

U. S. DAILY AND AVERAGE PRICES

Jan. 1952	Electrolytic Copper (a) Domestic	Electrolytic Copper (b) Export	Straits Tin New York	Lead New York	Lead St. Louis	Zinc East St. Louis
1	Holiday	Holiday	Holiday	Holiday	Holiday	Holiday
2	24.200	27.425	103.000	19.000	18.800	19.500
3	24.200	27.425	103.000	19.000	18.800	19.500
4	24.200	27.425	103.000	19.000	18.800	19.500
5	No Market	27.425	103.000	19.000	18.800	19.500
7	24.200	27.425	103.000	19.000	18.800	19.500
8	24.200	27.425	103.000	19.000	18.800	19.500
9	24.200	27.425	103.000	19.000	18.800	19.500
10	24.200	27.425	103.000	19.000	18.800	19.500
11	24.200	27.425	103.000	19.000	18.800	19.500
12	No Market	27.425	103.000	19.000	18.800	19.500
14	24.200	27.425	103.000	19.000	18.800	19.500
15	24.200	27.425	103.000	19.000	18.800	19.500
16	24.200	27.425	103.000	19.000	18.800	19.500
17	24.200	27.425	103.000	19.000	18.800	19.500
18	24.200	27.425	103.000	19.000	18.800	19.500
19	No Market	27.425	103.000	19.000	18.800	19.500
21	24.200	27.425	103.000	19.000	18.800	19.500
22	24.200	27.425	121.500	19.000	18.800	19.500
23	24.200	27.425	121.500	19.000	18.800	19.500
24	24.200	27.425	121.500	19.000	18.800	19.500
25	24.200	27.425	121.500	19.000	18.800	19.500
26	No Market	27.425	121.500	19.000	18.800	19.500
28	24.200	27.425	121.500	19.000	18.800	19.500
29	24.200	27.425	121.500	19.000	18.800	19.500
30	24.200	27.425	121.500	19.000	18.800	19.500
31	24.200	27.425	121.500	19.000	18.800	19.500
AVERAGES FOR MONTH						
Jan.	24.200	27.425	109.404	19.000	18.800	19.500
AVERAGES FOR WEEK						
Jan.						
2	24.200	27.425	103.000	19.000	18.800	19.500
9	24.200	27.425	103.000	19.000	18.800	19.500
16	24.200	27.425	103.000	19.000	18.800	19.500
23	24.200	27.425	109.167	19.000	18.800	19.500
30	24.200	27.425	121.500	19.000	18.800	19.500
CALENDAR WEEK AVERAGES						
Jan.						
5	24.200	27.425	103.000	19.000	18.800	19.500
12	24.200	27.425	103.000	19.000	18.800	19.500
19	24.200	27.425	103.000	19.000	18.800	19.500
26	24.200	27.425	118.417	19.000	18.800	19.500

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis. All prices, except gold and silver, are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.300c. per pound, the average differential for delivery charges.

(b) Our export quotation for copper reflects prices obtaining in the open market and is based on sales in the foreign market reduced to the f.o.b. refinery equivalent, Atlantic seaboard. On f.a.s. transactions we deduct 0.075c. for lighterage, etc., to arrive at the f.o.b. refinery quotation.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingotbars; cathodes are sold at a discount of 0.125c. to 0.13c. per pound. Quotations for zinc are based on Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East and Middle West, effective Jan. 1, 1951, commanded a premium of 1.35c. per pound over the current market for Prime Western; Special High Grade 1.50c.

Quotations for lead are based on domestic common lead. Corroding lead commands a premium of 10 points.

(c) The daily New York silver quotation reported by Handy & Harman is for silver contained in ores and other unrefined silver-bearing materials, in cents and fractions of a cent per troy ounce. It is determined by Handy & Harman on the basis of actual sales of bar silver .999 fine in amounts of 50,000 ounces or more for nearby delivery at New York, as reported daily by regular suppliers, and is usually one-quarter cent below the price paid for such bar silver, this deduction being the allowance to such suppliers for carrying, delivering and marketing. In addition to foreign silver, the quotations also apply to domestic silver if such silver enters into the New York market.

The Treasury's purchase price of newly mined domestic silver is 90.5c. per troy ounce 1000 fine, effective July 1, 1946. London silver in pence per troy ounce, basis .999 fine.

(d) U.S. Treasury's gold price. Actual payment by the United States Treasury for gold is at 99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

Silver, Gold and Sterling

DAILY AND AVERAGE PRICES

Jan. 1952	Sterling Exchange "Checks"	Silver (c) New York	Silver London	Gold London	Gold (d) United States
1	Holiday	Holiday	Holiday	Holiday	Holiday
2	278.000	88.000	77.000d.	248s.	$35.00
3	278.000	88.000	77.000d.	248s.	35.00
4	278.000	88.000	77.000d.	248s.	35.00
5	(a)	(a)	(a)	(a)	35.00
7	278.000	88.000	77.000d.	248s.	35.00
8	278.000	88.000	77.000d.	248s.	35.00
9	278.000	88.000	77.000d.	248s.	35.00
10	278.000	88.000	77.000d.	248s.	35.00
11	278.000	88.000	77.000d.	248s.	35.00
12	(a)	(a)	(a)	(a)	35.00
14	278.000	88.000	77.000d.	248s.	35.00
15	278.000	88.000	77.000d.	248s.	35.00
16	278.000	88.000	77.000d.	248s.	35.00
17	278.000	88.000	77.000d.	248s.	35.00
18	278.000	88.000	77.000d.	248s.	35.00
19	(a)	(a)	(a)	(a)	35.00
21	278.000	88.000	77.000d.	248s.	35.00
22	278.000	88.000	77.000d.	248s.	35.00
23	278.000	88.000	77.000d.	248s.	35.00
24	278.125	88.000	77.000d.	248s.	35.00
25	278.125	88.000	77.000d.	248s.	35.00
26	(a)	(a)	(a)	(a)	35.00
28	278.125	88.000	77.000d.	248s.	35.00
29	278.125	88.000	77.000d.	248s.	35.00
30	278.125	88.000	77.000d.	248s.	35.00
31	278.125	88.000	77.000d.	248s.	35.00
AVERAGES FOR MONTH					
Jan.	278.034	88.000	77.000d.	—	$35.00
AVERAGES FOR WEEK					
Jan.					
2	278.375	88.000	—	—	—
9	278.000	88.000	—	—	—
16	278.000	88.000	—	—	—
23	278.000	88.000	—	—	—
30	278.125	88.000	—	—	—

Calendar week averages, New York Silver: Jan. 5th, 88.000; 12th, 88.000; 19th, 88.000; 26th, 88.000.

(a) No market (Saturday).

E&MJ HIGHLIGHTS

Reviewing what our industry accomplished in 1951, you'll notice . . .

- **On the cover,** a picture of Howard Young—the man largely responsible for the mining industry's two great accomplishments: 1) making effective plans to increase productive capacity. 2) acting on those plans. The results will be felt only slightly in 1952, but increasingly in 1953 and strongly in 1954.

- **Physical output** of most metals and minerals was up from 1950. Percentagewise, the leaders were tungsten, molybdenum, iron ore, and zinc. Copper weathered many dismal predictions and came through with a 5% increase. But our output of manganese and lead—both critically needed—was down. In the cellar was gold, down 15% from 1950.

- **With an increase in the price** of most mineral commodities, dollar volume was up even more. Nonferrous production (physically up 3%) rose 27% in dollar volume.

Highlights in the news:

- **Possibly in 1952,** and almost certainly in 1953, you'll see someone showing off with his new wrist radio. When you do, remember that germanium is responsible. Be sure to read "Germanium Promises . ." on page 154. Then remember what Mr. Wilson said (see below) about "fantastic weapons."

- **Taconite got another boost** when Reserve Mining Co. got two quick write-off permits totaling $112-million. Page 161.

- **Almost lost on page 190,** you'll find a time-table of school functions at the New York meeting of AIME.

Copper, still a center of action, became a center of argument:

- **Action.** Calumet & Hecla and DMPA signed the first agreement that provides for sustained production at high-cost mines. C&H will continue to produce from four Michigan mines on which it had been losing money. DMPA will buy the copper at prices determined by the anticipated cost of production.

- **Argument.** The degree of shortage (of copper) became a controversial subject. On one hand, government spokesmen have spoken in alarming terms of a continuing and increasing shortage. This month Cornelius F. Kelley spoke up for the copper industry; he says our copper supply will begin to improve starting early in 1952.

Quote and comment:

- **"The new, fantastic weapons** are all actuated electronically . . . We are preparing for a Buck Rogers' era, the atomic-fission, supersonic, electronics age, when yesterday's ideas are already on the way to the scrapheap, and we are clamoring for the ideas of tomorrow." *Charles E. Wilson, Director of Defense Mobilization.*

- **Several times recently,** Mr. Wilson has used the word "fantastic." Questioned as to its use, he says that it is the proper word and he will continue to use it. So, short of disbelieving him, we must accept Mr. Wilson's word that in the United States today there are weapons that can be accurately described as "fantastic."

ENGINEERING AND MINING JOURNAL

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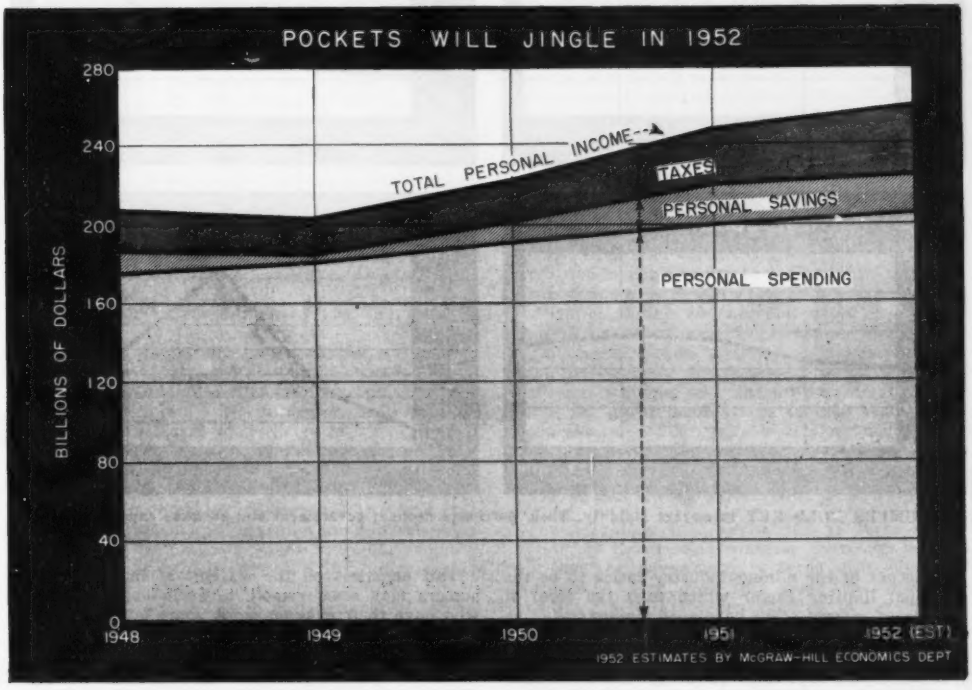


MINING PACE WILL INCREASE IN 1952

THE MINING INDUSTRY can look forward to continued high-level demand for its products during 1952. It will also be able to make a moderate increase in output—about 10%. These are our conclusions after a careful survey of available facts and opinions. However, as we appear to be drawing closer to a period of normal uncertainty, the reader should keep in mind that no prophets are infallible and none more dangerous than those who believe that they are.

The basic facts governing this viewpoint are simple. They are:

1. Despite lack of buyer enthusiasm in certain spots, primarily soft goods, the general level of economic activity and employment is high.

2. The definitely authorized and largely committed level of government spending is virtual assurance of a continued high level of economic activity during 1952.

3. The natural lull in buying interest after the surge of consumer spending which occurred after Korea has fairly well run its course.

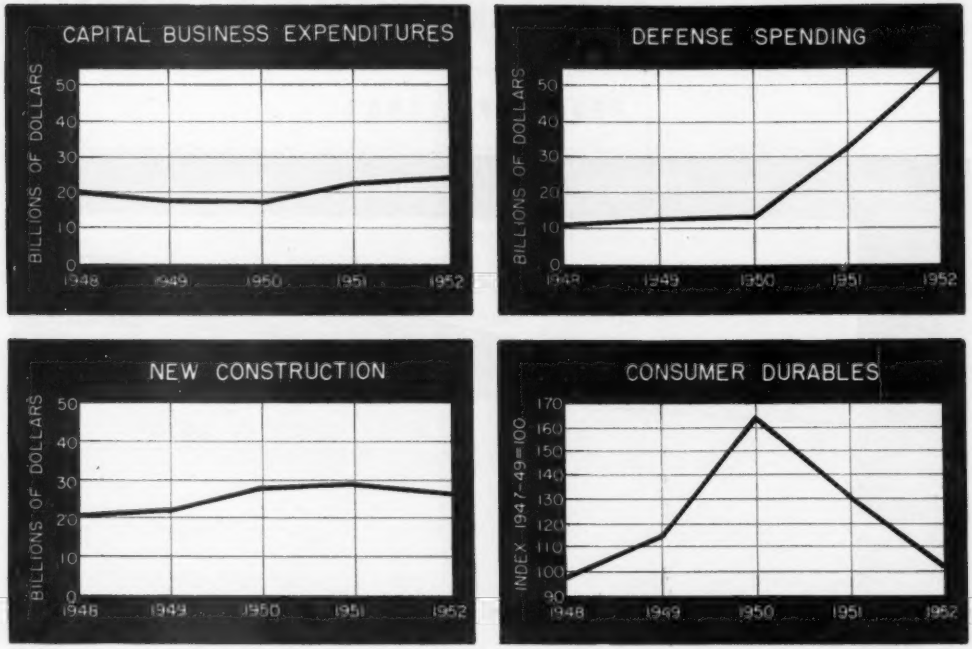
4. Consumers have plenty of money in their pockets.

5. Installment buyers have had time to accumulate the larger down payments demanded by government credit policy since Korea.

6. Capital goods industries are still on the upswing.

7. Most heavy industry (steel, mining, railroads, utilities, and construction) is still expanding, or would do so were mineral raw materials available.

These points seem incontestably to add up to continued demands on mining for all it can produce.



CONSUMERS HOLD KEY to market stability. Their purchases decline; government and business expenditures up.

The output of the mining industry seems to be the principal limiting factor which fixes the level of activity of several other hard-goods industries.

Consumer Is Boss

However, the experience of certain industries during 1951 underscores the maxim that individual consumers are bosses of the market places. The individual decisions of a myriad of John Smiths and Mary Szymanskis as to whether to buy or not to buy add up to the most important single determinant of the level of economic activity—seconded by a deficit-spending government.

The Johns and Marys asserted their sovereignty rather harshly during 1951 over textiles and many retail sellers, causing a limited depression in the midst of a general boom. Also, although a nominal bottleneck was imposed on automobiles, radio and appliance production by materials restrictions, this curtailed output seems to have met the demands of consumers fairly well. At no time during the year 1951 were these items difficult to obtain. Housewives also displayed substantial resistance to higher food prices.

Many people have offered explanations of this recalcitrant attitude on the part of consumers, such as credit restraints on installment transactions, the natural aftermath of a buying wave, increased taxes, resistance to high prices, resentment at declines in quality, and fear of a post-defense slump. Nevertheless, no analysis has been sufficiently convincing to dispel a certain mystery about why consumers act as they do. Apparently the views of taxicab drivers as guides to public opinion have lost a part of their magical portent!

This emphasis on the activity of individual consumers may seem remote to some mine operators who have their eyes on more immediate customers, such as metal fabricators. But raw-material producers should never forget that in a modern economy, we are all our brothers' keepers. The whole structure is endangered by weakness in an important segment—and the Johns and Marys are still in control whether economically or politically. Mining cannot prosper for long in a disabled economy. It cannot fail to do at least fairly well in a healthy one.

Prices Another Story

Although in most circumstances strong demands and high prices go together, 1952 seems likely to develop a few departures from normal behavior because of activities of the U. S. Government. In 1951 the U. S. domestic economy operated under price ceilings, while world mineral prices reached record levels. However, our government perceived that if it would hold to its price ceilings and keep U. S. consumers from competing in world markets at premium prices, it could eventually break world prices to our ceiling levels. This is because the rest of the world is not now able to absorb all foreign production. By the end of the year pursuance of this concept had broken the world lead price and softened the zinc market. Copper remained firm because our government permitted a 3¢ premium to be paid for imported metal and because U. S. commercial control of most Chilean production takes the bulk of this production off the world market.

Probably in 1952 the government will use its newly found power to hold world lead and zinc prices at ceiling levels. Whether it will be aggressive enough

to start drying up the supply by destroying the price incentives to produce, remains to be seen. That it can be unrealistic is amply demonstrated by its destructive moves in the tin market. Moreover, it has another card up its sleeve.

During most of 1951 our government tried, more or less fruitlessly, to effectuate international allocation of scarce materials. These attempts will continue in 1952. With equalized prices, chances of making the scheme work are greatly improved. Mineral producers should bear in mind that effective allocation of supply destroys whatever leverage sellers normally have on prices. In other words, allocation puts the control of prices into the hands of consumers, who are assured of their shares of supplies regardless of price. Prices become what an international bureaucracy decides is necessary to bring out the total tonnage required. Between the characteristic incompetence of bureaucracy in handling problems like this, and the fact that the dominant nations of the western world are all net consumers, the future of world prices is clouded with considerable uncertainty.

Government Influence Large

As stated above, a deficit-spending government plays a large part in sustaining business activity. Although buyer resistance to government I.O.U.s may develop sometime in the future, during 1952 the government will not have to curtail its spending programs through inability to finance them, incredibly wasteful as these programs are.

But the (unhealthy) stimulation of general business activity through deficit spending is only a fraction of government's influence on the mineral industry. The defense program places particular emphasis on hard goods, which are made from mineral raw materials. Government is a large customer for its stockpiling program and to some extent for foreign aid. It is in the market with price guarantees for certain minerals and may be with subsidies for others. It is offering easy-term loans, and risk-money participation in exploration and development, domestic and foreign. Its taxation policies have a profound impact. Indeed, one of its most profound influences during 1952 will be the amount of exploration and development undertaken as the result of a combination of punitive taxation, tax incentives and direct assistance. We hope that the results do not convince ambitious control-minded bureaucrats that a carrot and a club are better than two carrots, causing them to insist on the punitive backdrop to incentives as a permanent part of federal tax policy.

Many people, ourselves included, see an election year as a time when the administration will loot the Treasury before permitting a depression to occur. A contrary view points out that government spending is committed well in advance and thinks most people exaggerate the ability of government to affect economic conditions. Acknowledging some validity to both these points, we still think that the politicians who hold the nation's purse strings can and will exert a potent influence if pre-election economic conditions take an ominous turn. As quick-acting palliatives, they can lower the down-payment requirements for installment selling, can loosen bank credit, can reallocate scarce materials to consumer-goods production, and can use the immense propaganda facilities of government to promote feelings of well-being. Also, the spending plans of government have an important psychological impact, even though the actual disbursement of funds may be months away.

Ever-Normal Granary

One portentous development, the significance of which has been more or less overlooked, is the changed attitude of the industry toward the government security stockpile. When the stockpile law was passed, the general feeling was one of fear of possible liquidation. As a result, strong efforts were made, successfully, to allow for liquidation only under true emergency conditions. During 1951, however, the administration, with general approval by the industry, liquidated portions of the stockpile even though controls were established and relatively frivolous users were still in the market. The import of this action is that the stockpile has become a peacetime buffer stock, to be liquidated during shortage periods, and no doubt to be used as a repository for surplus production during periods of overproduction. Considering that truly protective tariff under current price concepts would amount to margins never dreamed of heretofore, and that the U.S. international position makes a return to protective tariff hardly feasible, it is easy to anticipate that past proponents of tariff protection will become advocates of a national or international buffer stockpile. The acquisition aspect is already fairly well established in open ended price-support contracts recently made to facilitate certain copper and zinc projects. In these contracts, the government agrees to take some of the production at a floor price if the producer cannot obtain this or a better price in the market place.

No Long-Term Surpluses

Taking a long look ahead, the producer or the investor in new mining ventures cannot be assured that they will never again be faced with short-term burdensome surpluses. But when the continued growth of per capita consumption is backstopped with anticipated population growth and world-wide aspirations toward better material living standards, it is impossible to escape the conclusion that the long-term problem is supply, not oversupply. In short, the owner of a good orebody will posses fundamental wealth. Will he liquidate it for whatever consumers choose to pay? Or will he demand that prices reflect something beyond mere operating costs and a nominal operating profit, reflecting value attributable to the resource itself?

Manpower Shortages

During the summer and early fall of 1951, some mining areas experienced serious manpower shortages. Subsquently the manpower supply improved because of a normal seasonal lull in competing activities. During the period of distress, no segment of domestic mining was as forehanded in solving its problems as was Canadian mining, which obtained a substantial number of European displaced persons to good advantage. Government analysts believe that as the defense production effort passes from the tooling-up to the production stage, manpower shortages will be more acute and will be complicated by expanding activity in the mining industry itself. On balance, we believe that labor problems will give the industry its worst headaches in 1952 and that it would be wise to set up a D.P. recruitment organization in advance. This would be cheap insurance against what may become a serious problem, and if the industry waits for the problem to overtake it, months will elapse before relief can be provided.

Metals in REVIEW

Gold

World's production fails to rise, premium prices decline, gold begins flowing back to U.S., as international economic problems grow knottier.

DR. M. A. KRIZ [1]
New York, N. Y.

LAST YEAR'S GOLD DEVELOPMENTS were marked by three salient features: First, world gold output (excluding the USSR) remained in 1951 at the same level, about 24-million fine oz., as in 1950. The annual rise in world gold output of about 3½% from 1947 to 1950 thus appears to have been interrupted.

Secondly, of the current world gold production a considerable proportion went into non-monetary uses, i.e. the professions, arts, and industry, as well as private hoards. It was to a considerable extent because of this increased supply of new gold to premium markets, and perhaps also because the demand for gold was less insistent toward the close of the year than at its beginning, that the premium gold prices declined noticeably in 1951.

Thirdly, the monetary gold outflow from the United States, which began after the 1949 currency readjustments, came to an end in mid-1951. Beginning with July, the United States again acquired considerable amounts of foreign gold.

Output Rise Halts

The postwar recovery in the world production of gold seems to have come to a halt in 1951 (Table I). World gold output of some 24-million fine oz. last year appears to have been slightly lower than in 1950, on the basis of preliminary or incomplete data. The estimate for 1951 was 2.8-million oz. more than the postwar low of 1945, and 12.7-million below the all-time record of 1940. However, current output is well above the 1920-30 average, as may be seen from the accompanying chart.

The principal gold-producing countries either maintained their output last year unchanged at the 1950 level or actually experienced a small decline. South African production amounted in 1951 to some 11.5-million fine oz., a little below its output in the previous three years, although somewhat more than in 1947. Canadian output, which had risen each year since 1945, remained virtually unchanged in 1951 at some 4.3-million oz. In the United States gold output had increased in 1950 for the first time since 1947, but in 1951 apparently declined to about 2-million oz. (on the basis of the first 10 months). In Australia, the Gold Coast, and Southern Rhodesia, gold production remained likewise stationary. The only important producing countries that registered increases in output were Colombia, Nicaragua, the Belgian Congo, and the Philippines.

Although 1951 was the second full calendar year after the 1949 currency readjustments, gold output last year was little affected by the rise in the gold price caused by the devaluations of national currencies of countries which account together for some 80% of world gold output outside the USSR. Even in 1950 most of the increase in output had been in the United States, which maintained its gold price unchanged, and in Canada and Belgian Congo, which had raised their prices only by 10 and 14%. In the sterling-area countries there had been no significant change in 1950, although they raised the price by 44%. In the year 1951, sterling area

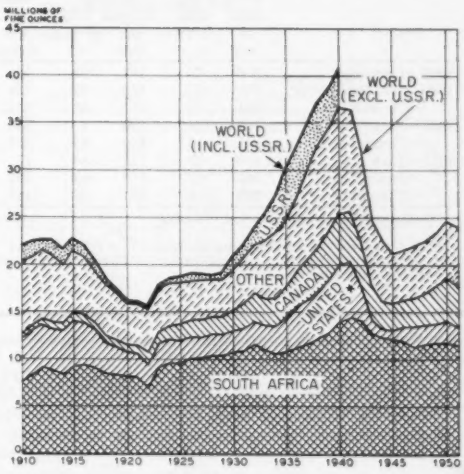
[1] The author is on the staff of the Federal Reserve Bank of New York. The views he expresses are his own and are not meant to reflect those of the Bank.

Table I.—World Gold Production

(IN MILLIONS OF FINE OUNCES)

	1940	1948	1949	1950	1951[a]
North America:					
Canada	5.3	3.5	4.1	4.4	4.3
United States	4.9	2.0	1.9	2.3	2.0
Central and South America:					
Mexico	0.9	0.4	0.4	0.4	0.4
Colombia	0.6	0.3	0.4	0.4	0.5
Chile	0.3	0.2	0.2	0.2	0.2
Nicaragua	0.2	0.2	0.2	0.2	0.3
Africa:					
Union of South Africa	14.0	11.6	11.7	11.7	11.5
Gold Coast	0.9	0.7	0.7	0.7	0.7
Southern Rhodesia	0.8	0.5	0.5	0.5	0.5
Belgian Congo	0.6	0.3	0.3	0.3	0.4
Asia:					
India	0.3	0.2	0.2	0.2	0.2
Philippines	1.1	0.2	0.3	0.3	0.4
Oceania:					
Australia	1.6	0.9	0.9	0.9	0.9
Total	31.6	21.0	21.8	22.5	22.3
Other countries, excluding USSR	5.1	1.6	1.8	1.7	1.7
World, excluding USSR	36.7	22.6	23.5	24.3	24.0

[a] Tentative figures based on preliminary or incomplete data. Note: Figures may not add up to totals because of rounding.



output actually declined slightly.

The higher gold price was, of course, merely an incidental result of the currency devaluations. Nevertheless, it enhanced in varying degree the profitability of gold mining. Output seems to have failed to respond to a higher gold price owing to the policy of mining companies to mill lower-grade ore whenever the price-cost relation became more favorable, and thus prolong the life of the mines. However, the higher gold price has already been offset to some extent by an increase in operating costs.

Apart from the effects of the 1949 currency readjustments and the rise in operating costs, the profitability of gold mining was affected last year by several other developments. In South Africa, the taxation of mining profits, which had been reduced in 1948 was restored in 1951 to the previous level, when producers increased their profits by selling gold in the free markets. Such sales brought additional revenue to the industry, more particularly in the latter part of 1950, as well as in 1951 when it thus sold some 40% of its output. The additional revenue from premium sales by South African mines amounted to $2 per oz. in the early part of 1951 but declined toward the close of the year; in the second half of 1950 it had amounted to roughly 70¢.

In the latter part of 1951, following the reinterpretation of the International Monetary Fund's gold policy discussed in the next section, Canada, Southern Rhodesia, Australia, and other gold-producing countries adopted a policy of allowing the gold industry, on certain conditions, to sell part of its current output for non-monetary uses at premium prices. In Southern Rhodesia and West Africa, premium sales were to be limited to about 40% of current output, a purely arbitrary figure that corresponds to the proportion of newly mined gold that South Africa was selling for non-monetary uses in mid-1951. However, following the Fund's announcement on premium gold transactions, the South African Treasury stated that under certain circumstances it would reduce this proportion. In Canada and Australia, on the other hand, there was no specific limitation on the amount of premium sales. In Canada, however, a further condition was established, that producers who sell gold in premium markets must forego subsidies. The Emergency Gold Mining Assistance Act that had provided for the subsidy that was scheduled to lapse at the end of 1951, was extended for another two years. In Canada, as well as in Australia, Southern Rhodesia, and West Africa, it was stipulated that premium sales be made against payment in United States dollars. In South Africa, the payment of premia, but not of the official dollar gold-price equivalent, was accepted in currencies other than United States dollars. However, with the free gold price at about $38.75 per fine oz. toward the end of 1951, the margin of profitability offered by the premium market appeared rather narrow.

Decline in Premium Prices

The second outstanding gold development last year was the decline in premium gold prices. The price at which gold is traded in the various markets directly for United States dollars, a price whose limited significance will be explained below, stood apparently at $44 per fine oz. early in January, 1951, but at the year-end it was reported at about $38.75. In mid-1950, prior to the outbreak of hostilities in Korea, this price reportedly was at about $36, or very close to the United States Treasury price. Following the Korean emergency it rose sharply, although at no time did it reach the high of $55 per fine oz. that apparently obtained in May, 1949.

Not too much should, however, be read into these prices. As is well known, there is no free market for gold coin or bullion in the United States; gold quotations that are referred to as dollar prices actually

Table II.—Free-Market Gold Prices

	Hong Kong HK$ per tael	Hong Kong US$ per fine oz.[1]	Bombay Rupees per tola	Bombay US$ per fine oz.[2]	Alexandria E£ per dirhem	Alexandria US$ per fine oz.[2]	Paris Francs per gram	Paris US$ per fine oz.[3]
1948—December	296	49	113	91	153	63	808	49
1949—Mid-September[4]	330	47	114	92	154	64	629	52
—December	291	39	114	64	169	47	580	46
1950—Mid-June[5]	262	38	113	63	151	42	440	39
—December	306	45	112	63	155	43	524	42
1951—June	304	43	115	64	157	44	514	43
—September[6]	341	43	110	62	162	45	573	44
—December	320	42	107	60	163	45	572	42

[1] Converted at the free-market exchange rate.
[2] Converted at the official exchange rate.
[3] Converted at "parallel" market rate.
[4] Prior to the currency devaluations.
[5] Prior to the outbreak of Korean hostilities.
[6] Prior to the International Monetary Fund's policy statement.

reflect transactions by foreign speculators and traders in foreign countries in gold that is either located outside the United States or is merely shipped into the United States for refining and re-export. It should be expressly noted that the United States dollar equivalents given in Table II are in no sense real quotations, but are merely computed figures arrived at by converting the local-currency price into dollars at such rates of exchange as may be available.

In the Far East, where gold premia are highest, dollar transactions are relatively few and unimportant; hence the so-called Far Eastern dollar prices of gold which are the highest ones extant, especially lack realism. In Western Europe, on the other hand, free or black-market dollar transactions are of some importance; and when the respective rates are used to convert the local-currency gold prices, the apparent dollar premia are much smaller than in the East.

Reason for Decline

The decline in the premium gold prices in 1951 can be attributed partly to gold releases for non-monetary purposes from official holdings, and partly to the increased proportion of the supply of newly mined South African gold made available to premium markets. With the making of arrangement for such sales of newly mined gold in Canada, Southern Rhodesia, Australia, and other countries in the fall of 1951, on the conditions already mentioned, premium prices registered a further decline. These arrangements were made after the issue by the International Monetary Fund at the end of September, 1951 of a new statement of policy, in which the Fund reiterated its view that gold should be concentrated in official monetary reserves and not allowed to leak away into private hoards.

Any appraisal of the Fund's gold policy must bear in mind that it was initiated in 1947 when monetary reserves outside the United States were declining rapidly and the payment difficulties that led to the European Recovery Program were already visible. Premium gold prices also directly or indirectly contributed to exchange transactions at depreciated rates at a time when the initial par values of currencies had only recently been agreed upon in the Fund and were not yet tested under postwar conditions. However, as world economic conditions improved up to mid-1950, gold flowed into official monetary reserves and premium gold prices tended to move toward the official United States gold price. The spread between the free-market and official gold prices thus narrowed, and as a result dealings in gold as a commodity ceased to interfere to any marked extent with its use as a monetary metal. This pre-Korean achievement should not be obscured by the post-Korean setback. **If a single lesson emerges from the Fund's experience with its gold policy, it is that the only way to reduce premium gold prices and curtail the disappearance of gold into private hoards is for each Fund member to follow economic, fiscal, and monetary policies that will create confidence in its currency.**

Gold Movements Reverse

The third salient gold development in 1951 was the reversal of the international movement of monetary gold, which brought to an end the gold outflow from the United States that began after the world-wide currency readjustments in September 1949. In actual fact, this reversal was very sharp. In the first quarter of 1951 the United States sold $880-million worth of gold to foreign countries, the highest quarterly outflow since September 1949. In the second quarter only $57-million was thus sold, the lowest outflow since the second quarter of 1950. In the third quarter, the United States actually bought $290-million worth from foreign countries. The United States net gold inflow during July-September was principally due to purchases of $340-million worth of gold from the sterling area, but these purchases, together with others from Latin America, were offset by United States sales to other areas.

As a result of these gold movements to and from the United States, together with the considerable disappearance of newly mined gold, as noted previously, there were important shifts in world monetary gold stocks, as indicated in Table IV.

U.S. Stock Low But Rising

In September 1951, foreign countries (excluding the USSR) held $12.1-billion worth of gold, as against 10.6-billion in September 1950 and 9.0-billion in September 1949; and conversely, the United States stocks at 22.2-billion in September 1951 were still 1.4-billion lower than a year earlier and 2.5-billion lower than in September, 1949. The United States in September 1951 held 61% of the world monetary gold stocks.

The recent pattern of gold transactions will, however, be better understood if account is taken not only of the monetary gold reserves, but also of the dollar assets held in the United States by foreign central banks and governments. Such assets in September 1951 amounted to $19.5-billion, as against $18.1-billion a year earlier and $14.6-billion in September 1949. The September 1951 level was, however, $0.3-billion lower than that of June 1951, and a further decline occurred in the last quarter of 1951. The third-quarter decrease was particularly large in the case of the sterling area ($0.6-billion).

The reversal in international monetary gold movements reflected in turn certain basic

changes that occurred last year in world economic conditions. Broadly speaking, these changes seem to be the outcome of continued inflationary pressures in many foreign countries after the post-Korean inflationary upswing had subsided in the United States during the second quarter.

The United States economy responded more quickly to Korean developments than did those of most foreign countries. More particularly, the volume of imports rose sharply; and the import expansion caused a great rise in the dollar earnings of the overseas sterling area, Latin America, and other primary-producing countries. This upward trend in United States imports came to an end in the second quarter. However, at the same time that imports declined considerably, exports went up with sustained demand from abroad. The net result was that the United States export surplus re-emerged on a greatly increased scale in the second half of 1951.

In most foreign countries, the post-Korean inflationary pressures developed later than in the United States; but, with the exception of Canada and some Continental Western European countries, it continued through 1951. The general demand for imported and domestic goods thus continued unabated; and imports greatly increased. The sterling area's gold and dollar position was influenced, in addition, by the suspension by the United States of tin puchases and of the strategic stockpiling of rubber and wool, by the accumulation of strategic stocks of raw materials in the United Kingdom, by the loss of Iranian oil, and by the payment of the first year's interest and installment of principal on the United States and Canadian loans received in 1946. Another special factor was the rise in import costs of some industrial countries of Western Europe under the impact of world commodity price advance. The deterioration in terms of trade had not been made entirely good at the year end. The gold and dollar position of some countries was likewise affected by capital movements.

Several countries had recourse to monetary controls for the first time since the war, and others strengthened earlier postwar monetary restraints; in addition, most countries raised taxation and made cuts in non-defense government expenditures. Principally as a result of these measures, some Continental Western European countries succeeded in noticeably improving both their domestic and their international positions in the latter part of 1951. However, for other countries the latter part of the year was marked by a serious setback to the relative internal stability and external viability that they had attained in early 1951.

Table III.—U. S. Gold Purchases From Foreign Countries

(In millions of dollars; negative figures indicate net sales by the United States)

	1948	1949	1950	1951 January-March	1951 April-June	1951 July-Sept.
Sterling area	1,233	642	−1,007	−400	−67	340
Continental Europe[1]	192	−250	− 364	−193	−24	− 25
Latin America	82	−148	− 172	−237	73	11
Asia and Oceania	− 4	− 52	− 39	− 23	− 4	− 5
All other countries	7	2	− 148	− 28	−35	− 31
Total	1,510	193	−1,730	−880	−57	290

[1] Almost entirely Western European countries participating in the European Recovery Program.

For more detailed data, see the *Federal Reserve Bulletin*.

Table IV.—World Monetary Gold Reserves

(In billions of dollars)

	Dec. 1945	Sept. 1949	Sept. 1950	June 1951	Sept. 1951[p]
United States	20.1	24.7	23.6	21.9	22.2
All other countries[1]	13.7	9.0	10.6	12.4	12.1
International institutions[2]	....	1.5	1.6	1.7	1.7
World[1]	33.8	35.3	35.8	35.9	36.0

[p] Preliminary
[1] Excluding USSR; partly estimated.
[2] International Monetary Fund and Bank for International Settlements.

Note: Totals do not necessarily add up because of rounding.
For data for individual countries, see the *Federal Reserve Bulletin*.

The Outlook for 1952

As for 1952, there were too many elements of uncertainty at the year-end for it to be possible to foresee the probable gold movements. Raw material market prospects, the availability of United States exports, the affects of the United States military and economic-aid programs, the course of accelerated rearmament in the United States as well as in other countries, inflationary pressures in this country and abroad, and various other factors bearing upon the balances of payments were too conjectural in character to be adequately assessed. Nevertheless, there seemed no reason to anticipate a repetition of the gold avalanche that poured in upon the United States from 1947 to September, 1949.

As of the year-end, the world once more faced complex and delicate problems in the field of international payments. Although it was by no means clear how these problems could be dealt with most effectively and expeditiously, one thing was certain—namely that international liquidity could not be improved in the long run by a mere rise in the world price of gold. Nor would such a rise be of any help in attacking the fundamental problems of economic growth and productivity that are faced by Western Europe, as well as the primary-producing countries of Latin America, Asia, Oceania, and Africa. Finally, under the existing conditions of world-wide full employment coupled with rearmanent, a higher gold price would greatly complicate the task of the monetary authorities in many countries in implicating policies of monetary restraint.

Silver Production

(Handy & Harman)

IN MILLIONS OF OUNCES

	1949	1950	1951(a)
United States	34.6	42.1	40.0
Canada	17.6	22.4	23.0
Mexico	49.5	49.1	41.0
Peru	10.6	13.5	13.5
Bolivia	6.6	6.6	6.7
Other South and Central American countries	6.7	6.9	6.5
Western Hemisphere	125.6	140.6	130.7
Outside Western Hemisphere (b)	23.0	24.5	24.5
World production (b)	148.6	165.1	155.2

(a) Estimates. (b) Partial.

Silver Consumption

Arts and industries:			
United States	90.0	120.0	110.0
Great Britain	11.5	12.2	16.5
Germany	.....	9.6	11.5
Canada	5.2	5.2	4.6
Mexico	1.5	2.5	2.0
Totals	108.2	149.5	144.6
Coinage:			
United States	13.5	24.6	44.4
Saudi Arabia	13.5	.....	21.0
Germany	.....	.....	9.9
Mexico	.9	3.8	4.5
Canada	1.2	3.8	3.8
China	32.5	.....	.....
Other countries	9.0	1.5	.4
Total	70.6	33.7	84.0
Total consumption	178.8	183.2	228.6

(a) Partial.

Silver

Mexico strengthens position as leading factor in world's silver markets. U. S. faces rising demand for silver coins. Political front quiet in 1951

DICKSON H. LEAVENS, Colorado Springs, Colo.

MEXICO HAS CONTINUED TO BE the principal factor in the silver market during 1951. The Bank of Mexico purchases the entire domestic production, uses some for Mexican coinage, and sells directly to foreign governments, either in bars or in coins manufactured for them at the Mexican Mint. It also sells on the New York market, where at times it makes purchases to support the price.

Mexico has adopted an aggressive sales policy. Early in the year a contract was signed with Saudi Arabia for minting 50-million rials, using about 18-million fine oz. Later in the year another contract was negotiated for 8-million oz. On June 27, Carlos Novoa, director of the Bank, announced that Mexico would export no more silver to the market during 1951, since all would be needed for domestic and foreign coinage (actually small supplies were exported to New York during the second half of the year).

In October, the Mint began delivering to the Bank new 5-peso silver coins of which it was producing 100,000 per day. These coins were of a content related to the current price of silver, in contrast to former coins which had disappeared from circulation when the price passed their bullion parity. It was stated that the new coins were intended to give people a medium for saving, that is, hoarding.

In the autumn the Bank announced that it would supply the West German Government with 12-million oz. of silver, and that negotiations for the sale of 10-million oz. to Pakistan were under way. A proposal for a special mining bank was also being discussed, in the hope that the production of gold and silver could be greatly increased and the country's monetary reserves be built up.

Price

The year opened with the official price for foreign silver in New York at 80¢ per oz., 0.999 fine. A shortage of supplies soon developed, probably owing to lack of Mexican offerings, and on Friday, January 5, there was no quotation. Suppliers asked 90¼¢, but purchasers were unwilling to pay as they feared that price controls would not allow them to pass on the higher price to consumers. When it was determined that price controls did not extend to foreign silver, a price of 90.16¢ was set on Monday, January 8. This represented the Treasury price for newly mined domestic silver of 90.5¢ per oz. fine, or 90.41¢ per oz. 0.999 fine, less the usual 0.25¢ differential between actual and "official" prices. It was the highest price that silver had reached since the decline from the peak of $1.37½ in late 1919, although it was at 90⅛¢ for some months in 1946.

This price held until June 7, when demand fell off before factory vacations and the price dropped to 87¾¢, rising again to 90.16¢ on June 28 after the Mexican announcement of no more sales to the market. On October 4 it dropped again to 84¾¢ for one day, but recovered to 88¢, at which it held for the remainder of the year. The October drop was ascribed to lessened demand for silverware needs for the Christmas trade, to considerable

stocks on hand, and to some transactions by Dutch operators who were able to acquire "transferable sterling" at around $2.45 per lb., as compared with the official rate of $2.80 and with such funds, purchase in London "exportable silver" for shipment to New York. Supplies of these particular kinds of exchange and of silver, however, were too limited to allow large operations of this nature.

In London the official price for silver for internal essential trade requirements followed the New York price closely, starting the year at 70d. per oz., 0.999 fine, rising to 78½d., and ending the year at 77d. "Exportable silver" commanded a premium of from 1d. to 5½d. depending upon temporary conditions.

In Bombay, where the silver market has been insulated from the rest of the world since 1939 by restrictions on import and on supply of foreign exchange, transactions are limited to silver already in the country, and are subject to varying demand from the ornament trade and to liquidation of ornaments in time of stress, as well as to considerable speculative activity. The price ranged between the equivalents of about $1.02 and $1.17, the peak being reached in July and leading the State Government of Bombay to impose a system of margins of about 20% to be deposited by bulls or bears when the daily price change amounted to about 3½¢ up or down respectively.

Figures for 1951 as far as available are given in the accompanying table. Of the principal silver-producing states, only Utah showed a gain; Arizona, California, and Montana about held their own; Colorado, Idaho, and Nevada declined. Individual gains were largely due to increased production of base metal ores, while in the second half of the year some of this production was curtailed by strikes. Production in Mexico continued the decline it has shown since its postwar peak of 59-million oz. in 1947 and its all-time high of 109-million oz. in 1929.

Imports of silver ore and bullion during the first half of the year were somewhat less than in 1950, and during the latter half were considerably less because of the reduction of imports from Mexico. Imports from Canada and other countries stood up well or increased. Of foreign silver coin, the principal supplies were some 5-million oz. from Spain in April and some 12-million oz. from Cuba in June, making a total of about 30-million oz. from the latter country since shipments began in 1950. Not all of this, however, has come on the market.

Little was heard of silver in Congress during the year. Representative Celler introduced his usual bill for the repeal of silver purchase laws, but it did not get out of Committee; and Senator Green of Rhode Island, usual spokesman for the silverware manufacturers of New England, did not present any measure. Neither silver producers nor silver users seemed anxious to stir up the question.

The United States Treasury has continued to absorb newly mined American silver at the statutory price of 90½¢ per oz. These purchases have amounted to about 36-million oz., of which 70% has gone into the silver certificate reserve, revalued at $1.29 per oz., while the remaining 30% (the seigniorage) has gone into the General Fund at cost. But this "free silver" in the General Fund has been drawn on for subsidiary coinage to the extent of about 45-million oz. Thus the bullion in the certificate reserve has increased from 1,578-million oz. on January 1 to 1,604-million oz. on December 31, while the bullion in the General Fund has decreased from 160-million oz. to 127-million oz. during the same period. Of the above silver, 402-million oz. are still "held by certain agencies of the Federal Government" representing the unreturned part of the metal loaned for industrial purposes during World War II.

Coinage

During the first four months of the year the mints were comparatively inactive, but by May the demand for silver subsidiary coins revived and during the remainder of the year the coinage of these averaged about $7-million per month. The enormous production of subsidiary silver coins in the last two decades has used 620-million fine oz. of the white metal, largely obtained from the "free silver" representing seigniorage profit on silver bullion placed in the certificate reserve.

Copper

Inflated demands continued throughout year. Foreign price raised under Chilean agreement; domestic ceiling unchanged. Double-pricing standard cuts U.S. imports. Production to rise in 1952.

H. H. WANDERS, Market Editor

DEMAND FOR COPPER continued at an inflated level throughout 1951. On top of an expanding defense program, defense supporting projects came into the picture on a scale that seemed unrealistic. These projects embraced everything from the most modern plants down to housing. The utilities added to their capacities. Ordinary civilian needs also remained abnormally high, notwithstanding restrictions on end use and limitations on inventory. This called for heavy tonnages of copper for immediate consumption that could not be supplied out of current production.

Apparent consumption of copper in the United States in 1951, measured in terms of shipments of copper and copper-bearing products by fabricators (wire and brass mills) to their customers totaled 1,394,960 tons, against 1,438,237 tons in the preceding year, and 1,053,225 tons during 1949.

The World War II peak in apparent consumption of copper in this country was 1,701,753 tons in 1943. In that period, unlike 1951, foreign copper had no place to go except to the United States. Inflation had not taken its toll and prices were fixed at comparatively low levels. In short, much of the world's production of copper was available to the United States on its own terms.

Controls, first voluntary and then mandatory, established a ceiling price in this market in 1951 of

Copper Statistics—1947 to 1951

The following summary of copper statistics, reported by members of Copper Institute, accounts for all but a small percentage of the world's production. It excludes the U.S.S.R. and countries behind the Iron Courtain, as well as a few countries of minor importance. The figures are in short tons.

	Crude Production — Primary	Crude Production — Secondary	Refined Production	Deliveries to Fabricators	Stocks Refined End of Period
United States					
1947	871,391	105,307	1,196,393	1,383,666	76,035
1948	850,088	130,410	1,233,697	1,344,445	96,080
1949	772,986	135,052	1,056,463	1,031,595	116,027
1950	940,249	117,439	1,270,768	1,371,464	49,040
1951	964,076	56,810	1,199,784	(a)1,367,787	(b)71,528
Outside United States					
1947	1,229,825	8,995	1,016,856	921,851	143,979
1948	1,271,884	8,526	1,072,229	901,073	175,669
1949	1,270,529	10,241	1,076,114	933,641	147,972
1950	1,347,356	11,387	1,127,329	898,601	139,919
1951	1,378,171	5,360	1,225,018	1,013,450	152,203
Combined Totals—U. S. and Outside U. S.					
1947	2,101,216	114,302	2,213,249	2,305,517	220,014
1948	2,121,972	138,936	2,305,926	2,345,518	271,749
1949	2,043,515	145,293	2,132,577	1,965,236	263,999
1950	2,287,605	128,826	2,398,097	2,270,065	188,959
1951	2,342,247	62,170	2,424,802	2,381,237	223,731

(a) Includes tonnages delivered from government stocks.
(b) Includes tonnages delivered to U. S. consumers at foreign ports.

24½¢ a pound, delivered Connecticut Valley. Major foreign producers, taking a long term view of the market, did their best to maintain the world price at close to the same level. Then the State Department, in an extraordinary deal with Chile, granted a 3¢ "bonus" to the Chilean Government, an unheard of occurence that culminated in a general rise in the world price to the basis of 27½¢, f.a.s. New York equivalent. In the meantime, in the outside or premium market, really fancy prices were paid by foreign consumers in dire need of copper. In several instances as high as 60¢ a lb. was realized by dealers on resale lots. The outside market flourished and prices paid on a modest percentage of the world's output varied during the year between 36¢ and 60¢. Soft currency areas were particularly vulnerable in the "scalpers" market.

The spread of 3¢ between foreign and domestic metal brought on untold complications to both producers and consumers. Custom smelters, after some delay, were granted permission by the Office of Price Stabilization to market copper recovered from foreign concentrates acquired on the basis of the world price of 27½¢. Scrap found its way into the black market or was retained by consumers, with the result that receipts by custom smelters dropped sharply. But the Office of Price Stabilization, bent on holding down the lid on copper, refused to budge in its determination to maintain the 24½¢ domestic ceiling. Confusion over pricing copper continued throughout the year.

Marketing experts in copper were convinced at all times that a flat price of 27½¢ on domestic and foreign metal, once the 3¢ grant was made, along with strong support for maintaining this price by all friendly countries outside of the Iron Curtain, would have been reflected in a more orderly market and additional production.

Toward the end of the year, in a move to maintain maximum domestic copper production, the government announced that it was ready to negotiate over-ceiling contracts. It was revealed that the Defense Materials Procurement Agency was negotiating such agreements with operators of nine small mines whose annual output totals about 16,000 tons. The need, it was stressed repeatedly, was for an immediate increase in production.

Chilean Copper Deal

Unique in the year's developments was the Chilean agreement negotiated at the government level. Producers in Chile had little or nothing to do with the deal. That the Chilean authorities had been pressing for a higher price was known early in the year.

On May 7, our State Department announced that the United States and the Chilean Government completed a series of talks, held at the request of the President of Chile, "on outstanding problems with respect to copper."

It was agreed that production of copper in Chile should be expanded and in the case of the American companies, this is to be done without United States financial assistance, but with priority assistance for equipment. The agreement provided for a 3¢ rise in the price of Chilean copper sold in the United States.

The statement added: "The Chileans agreed to cease abnormal trade in semi-processed copper and taking cognizance of the need of maximum shipments of copper to the United States, agreed that no more than 20% of the production of the American companies will be reserved for Chile's own use and for export to other countries. Chile will take steps to limit such exports to essential requirements of friendly countries. . . . The United States Government has stated that it considered reasonable an increase of 3¢ per lb. in the price of Chilean copper sold in the United States. It is understood that prices to third countries will not be lower than the price to the United States."

What happened? The world price rose to 27½¢, New York equivalent. To comply with our OPS regulations, American companies producing copper in Chile had to sell the metal for shipment to the United States through their Chilean subsidiaries. During July it was announced that the Chilean authorities fixed the selling basis on their share of the 20% take to be exported at $1,200 per ton, equivalent to almost 54½¢ per lb. There were ready buyers at this level up to the end of the year. The producers supplied this copper to the Chileans at 24½¢.

Strikes Cut Output

Except for labor disturbances, mine output of copper in the United States might easily have exceeded 1-million tons. Production of crude copper obtained from primary sources totaled 964,076 tons in 1951, according to Copper Institute, the highest level since 1944. However, recovery of crude copper obtained from secondary material declined

from 117,439 tons in 1950 to 56,810 tons in 1951.

A breakdown in wage negotiations in August shut down more than 50 operations in 15 states engaged in mining, smelting and refining copper, lead and zinc. The emergency created by this disturbance brought prompt action by President Truman, who certified the dispute to the Wage Stabilization Board. A court injunction granted the United States sent the strikers back to their jobs early in September, but not until 40,000 tons or more of production had been lost to industry. The Wage Stabilization Board later approved a 15¢ hourly wage increase.

To supply some of the badly needed copper, the government released about 55,000 tons of copper from its emergency stockpile. This metal was distributed in varying amounts over the last five months of the year.

Work stoppages also cut into production of copper in Chile, and fuel and power shortages hit other areas outside of the United States. In spite of these difficulties, production of crude primary copper outside of this country increased moderately during 1951 to 1,378,171 tons, against an average of 1,299,553 tons a year in the five years ended 1951.

Copper Under CMP

In the early stages of the Korean conflict there was general backing in official quarters in Washington of a plan to control the flow of all strategic materials called for in the defense program through direct allocation of three key metals—steel, copper and aluminum. This plan was dusted off as the priority system obviously was heading for trouble. It became operative in July, 1951. Distribution of vital materials in an "open-end" priority arrangement proved embarrassing, particularly to suppliers. Realizing that it would take time to get CMP going on a workable basis, defense officials retained the defense order (DO) priority system until September. It was admitted that it would require at least two months to switch over to direct allocation.

During the fourth quarter of the year CMP was operating fairly smoothly, with consumers dealing directly with Washington for their supplies of copper instead of going to the producer.

Because of the seriousness of the supply situation in copper, the Munitions Board virtually ceased stockpiling the metal. It was estimated that not more than 65,000 tons of copper went into the strategic reserve during the year, and most of this tonnage was acquired in the early months of 1951.

Imports Essential

Our enormous requirements for copper could not be satisfied without large importations. Increased competition for the world's output, together with price limitations here reduced the available supply of foreign metal in this market from 506,839 tons in 1950 to approximately 363,000 tons in 1951. Our foreign trade in manufactured copper in 1950 and 1951, in tons, was as follows:

	1950	1951(a)
Imports		
In ore, matte, etc.	110,087	102,000
Blister (content)	224,222	143,000
Refined	317,090	242,000
	651,399	487,000
Exports		
Refined	144,560	124,000
Net imports 506,839		363,000

(a) Preliminary figures.

Chile supplied this country with approximately 210,000 tons of refined copper, 48,000 tons of blister, and 11,500 tons of copper in ores and concentrates during 1951. Imports from Chile were lower in 1951 than in the preceding year in all three classifications, owing chiefly to work stoppages.

The suspension of the import duty of 2¢ per lb. brought some relief in a thoroughly confused pricing situation. President Truman signed the measure that suspended the duty for a limited period, with safeguards, on May 22.

The law suspending the duty provides that the 2¢ tax imposed under Section 3425 of the Internal Revenue Code shall not apply with respect to copper entered for consumption or withdrawn from warehouse for consumption during the period beginning April 1, 1951, and ending with the close of Feb. 15, 1953, or the termination of the national emergency, whichever is earlier.

It also provides that when, for any one calendar month during such period, the average market price for electrolytic copper for that month, delivered Connecticut Valley, has been below 24¢ per lb., the Tariff Commission, within 15 days after the conclusion of such calendar month, shall so advise the President, and the President shall, by proclamation, not later than 20 days after he has been so advised, revoke such suspension of the import tax. The market price reported by *E&MJ Metal and Mineral Markets* will be used in determining the average price.

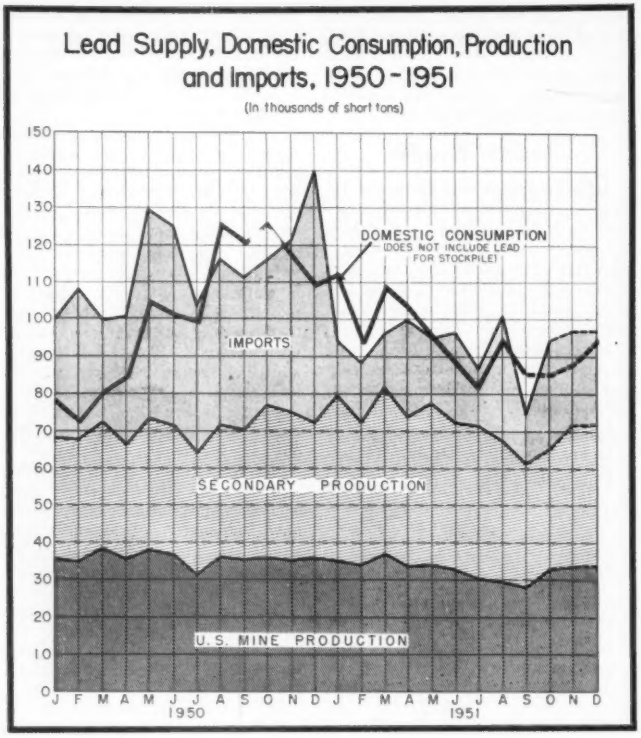
The official viewpoint in Washington was that copper would remain in short supply for an indefinite period. Producers objected strongly to efforts of the government to bring about the substitution of other materials for copper on the assumption that the shortage will be permanent. Domestic mine output, it was admitted freely, will increase only moderately in the first half of 1952, but thereafter the additions should be fairly substantial.

Cornelius F. Kelley, chairman of Anaconda, declared that the supply outlook for copper will begin to improve materially during the latter half of 1952. He took sharp issue with those government officials who have "conducted a systematic campaign that practically amounted to propaganda urging the substitution of aluminum for copper." By the end of 1953, he said, additional production from projects under way here and abroad will increase total supply 205,000 tons a year above present levels.

At the turn of the year the so-called outside or premium market for copper began to soften a little. Dealers and foreign speculators sensed a change in the situation that pointed to a tightening in controls outside of the United States, possibly through the operations of the International Materials Conference, which began functioning after a fashion in the fourth quarter of 1951. Allocations announced by the group so far have carried little weight and the quotas set up have been little more than "hunting licenses" to obtain a specific tonnage of the estimated supply.

The extremely tight situation in copper is likely to ease in the final quarter of 1952, providing there is some improvement in the international situation. Allocation is expected to continue throughout the year.

There is hope that our pricing officials will take a broader view of the special problems of the copper industry and simplify matters by returning to a one price system tied to the world price. As 1951 ended, it was the consensus in copper circles that a flat 27½¢ selling basis would do much toward stabilizing the entire market. Increased profits would go to the government anyhow.



Lead

Supply for domestic consumers was reduced during year by drop in imports that resulted from maintenance of ceiling price in the United States.

ROBERT L. ZIEGFELD, Secretary, Lead Industries Association, New York, N.Y.

PROBABLY OVERSHADING all the vexing problems which faced the lead industry in 1951 was the maintenance of a ceiling price in the United States well below the world market. This resulted in a drastic reduction in United States' imports of lead.

Estimated primary lead production and consumption for the years 1948-50 are shown in Table 1. While temporary shortages occurred during those years, the total supply for all three years, on the basis of available statistics, slightly exceeded total consumption including the large tonnages that went to stockpile. This indicates how closely demand and supply are in balance over a period of time and how small changes in either supply or demand can quickly change the balance.

It is impossible at this time to estimate accurately the statistical picture for the world for 1951. Nevertheless, it should be borne in mind that relatively new important foreign producing areas, notably Africa, are adding appreciably to the world supply and that other foreign producing areas are maintaining their production of the metal.

Although demand for lead exceeded supplies in the United States throughout most of 1951, the world situation appeared far less serious. In fact it is reliably reported that after a review of the world lead situation, the International Materials Conference decided, late in 1951, that international allocations of lead were not warranted.

The accompanying graph shows monthly lead supply and consumption in the United States by months in 1950 and 1951. The heavy imports late in 1950 reflect restoration of the full duty on lead on Jan. 1, 1951, due to abrogation of the reciprocal trade agreement with Mexico which had been in effect since 1943 and which had cut lead duties in half. Subsequently on June 6, 1951, lead duties were again halved (to 1 1/16¢ per lb. on pig and 3/4¢ on ore concentrates) as a result of the Torquay tariff conferences late in 1950.

Price Frozen Early

Lead entered the year 1951 with the domestic primary market quoted generally at 17¢ per lb. New York. In January the price was frozen at this level by the issuance of General Ceiling Price Regulation by the OPS. Lead products were also frozen at their January levels. Foreign lead, however, was not under any control and bidding by foreign consumers jumped the price of foreign lead to several cents above the domestic price. Therefore, more and more foreign lead was drawn away from the American market.

Meanwhile, recognizing the difficult position in which lead consumers had been put by the unrealistic ceiling price rulings and the unfairness to American miners, the Lead Industries Association, by resolution in May, urged defense authorities to suspend the duty on lead with automatic restoration of the duty if the price dropped, and also urged establishment of a more realistic price ceiling with relation to the world market. These recommendations were met only in part.

On Oct. 2 the OPS raised the domestic ceiling 2¢ per lb., but at the same time forbade United States' consumers to pay more than 19¢ for foreign lead with the duty for the account of the purchaser. An agreement was reached with Canadian producers to export lead to the United States at this price.

Also, a bill was introduced in Congress to suspend the duty on lead (1 1/16¢ per lb. on pig and 3/4¢ on

ore and concentrates) until March 31, 1953. It provided for automatic restoration of the duty if the domestic price fell below 18¢. The measure failed to pass the Senate on objection by one senator. The bill may come up for a vote early in 1952.

Mine production had been increasing steadily each year since 1946 until 1951 when it was down some 10% as compared with 1950. This resulted entirely from labor difficulties. There is little doubt but that production could have been increased in a more favorable labor climate. Results of postwar exploration and development in the United States have been encouraging, particularly in the northwest, although other areas are also potentially increased producers. Although figures are not available, domestic reserves have undoubtedly increased substantially.

Lead From Scrap

Production of lead from scrap showed an increase of almost 15% as compared with 1950. This probably reflected both the higher prices prevailing in 1951 and the ever increasing amount of lead used in storage batteries, the major source of scrap.

Another disrupting incident was the failure of OPS to increase price ceilings on lead scrap and lead products on Oct. 2, when the ceiling on primary lead was advanced 2¢. This omission was corrected Oct. 24 when these items were correspondingly increased.

In September, NPA placed domestic primary soft lead under allocation. This led to difficulties in the equitable distribution of lead as it only covered a comparatively small part of the total supply. Therefore, another order was issued placing imported lead under allocation starting with Jan. 1, 1952. NPA also announced its intention of issuing an order to control or direct the movement of scrap. Up to this writing, no such order has been issued.

Summarizing briefly, U.S. mine production fell off during the middle of the year but was improving toward the year-end. For the year as a whole (see Table 2) it was about 395,000 tons or some 10% below 1950. Imports, however, because of the unrealistic price ceilings, were off more than 50% to about 255,000 tons. The foreign market was weakening towards the year-end and the two markets were coming closer together. Scrap showed an increase over 1950 to 480,000 tons or almost 15%. This all added up to a total supply of 1,130,000 tons of lead in this country from the usual sources.

The supply was at its lowest ebb in September, October and November, and the government decided to release 30,000 tons of lead from its stockpile as an emergency relief measure. About 10,000 tons of this was allocated to industry in December, the balance to be used as needed after the first of 1952. In the last two months of the year, the government diverted to industry several thousand tons previously contracted for the stockpile but not yet delivered.

Total supply available to industry amounted to 1,140,000 tons..

A year earlier the total was 1,435,000 tons including 64,000 tons drawn from refiners' stocks. This

Table I.—Estimated World Primary Lead (Excludes U.S.S.R.)

(In Thousands of Short Tons)

	Production (a)				Consumption (b)			
	1948	1949	1950	3-Year Total	1948	1949	1950	3-Year Total
United States	390	410	430	1,230	665	540	810	2,015
Canada and Newfoundland	190	160	170	520	60	55	55	170
Mexico	215	230	260	705	5	5	5	15
South America	105	120	135	360	55	65	80	200
Europe	190	235	250	675	445	410	500	1,355
Australia	225	225	235	685	40	45	50	135
Africa	85	110	125	320	15	15	20	50
Other	15	10	15	40	35	30	45	110
Total	1,415	1,500	1,620	4,535	1,320	1,165	1,565	4,050
Stockpiling	....	....	....	....	10	210	170	390
Total	1,415	1,500	1,620	4,535	1,330	1,375	1,735	4,440

(a) On a mine basis.
(b) Primary lead only, regardless of country of origin, secondary lead excluded.

Table II.—U. S. Lead Supply and Demand

SUPPLIES	1950[1]	Estimated 1951
From:		
Domestic Ores	429,875	395,000
Foreign Ores and Base Bullion	78,873	75,000
Secondary	421,000	480,000
Imports of Metal	441,741	180,000
Delivered from Stockpile	.....	10,000
Total	1,371,489	1,140,000
Change in stocks at primary smelters and refineries	63,857 (Decrease)	.....
Total	1,435,346	1,140,000
DEMAND		
Industrial consumption	1,212,500	1,150,000
Change in Consumers' Stocks	24,600 (Incr.)	35,000 (Decr.)
Total	1,237,100	1,115,000
Apparent excess of supply over demand[2]	198,246	25,000

[1] American Bureau of Metal Statistics, U. S. Bureau of Mines, Lead Industries Association.
[2] Includes lead delivered to government stockpile.

Table III.—Use of Lead in The United States

(In Short Tons)

	1950 (a)	1951
White Lead	34,000	29,000
Red Lead and Litharge (b)	75,900	81,000
Storage Batteries	406,800	380,000
Cable Covering	136,800	130,000
Building (c)	61,500	66,000
Tetraethyl	111,100	128,000
Ammunition	32,800	38,000
Foil	3,300	3,000
Bearing Metal	33,100	34,000
Solder	88,100	73,000
Typemetal	30,900	24,000
Calking	61,100	44,000
Other Uses	136,600	120,000
Total	1,212,000	1,150,000

(a) American Bureau of Metal Statistics
(b) Exclusive of oxides for storage batteries
(c) Chiefly pipe, sheet and extrusions. Includes lead used in chemical construction.

means that the total supply was about 300,000 tons less in 1951 than in 1950, practically all from loss of imports. But in 1950 an estimated 170,000 tons went to stockpile and consumers increased inventories of pig lead 25,000 tons, whereas in 1951 they decreased inventories an estimated 35,000 tons. Actual industrial consumption was, therefore, off about 5% in 1951.

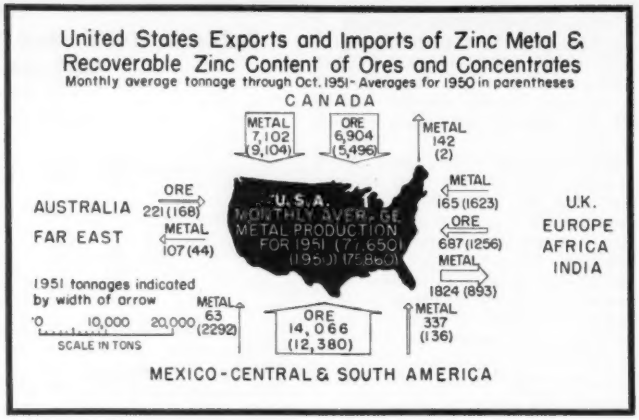
Under the terms of the Defense Production Act, the government tried various methods of increasing production. First through the Defense Minerals Administration and later the Defense Materials Procurement Agency, assistance was offered for exploration and development of lead properties through government participation in the cost, loans, long-term contracts at a floor price, and other means. A number of lead properties also received accelerated depreciation allowances.

Outlook Brighter

As the year drew to a close it appeared that the worst of the lead shortage had passed and that the outlook for adequate supplies was distinctly brighter. Lead is not the war metal that some of the other metals are. While some uses, like tetraethyl lead, will continue to expand, curtailment of automobile production, construction, and other civilian industries that use lead, may result in somewhat less pressure for lead products. There is little doubt that scare buying was responsible for much of the pressure on lead producers. Buyers seem to have realized that lead never was so far out of balance as some of the other metals.

Lead scrap should continue in good supply. Whether the mines will continue to have enough labor is problematical. Imports probably won't reach the record level of 1950, but they are likely to be substantially higher than in 1951.

The general feeling in the industry at the year-end is that consumers will have less trouble getting adequate supplies at prices they can afford to pay. However, lead consumption is expected to remain at a relatively high level, if, as most forecasters anticipate, general business remains active. There seems to be quite widespread feeling in the industry that removal of controls on lead will soon be in order. Also, should the market become at all easy, the 30,000 tons released from stockpile will probably have to be repaid.


United States Exports and Imports of Zinc Metal & Recoverable Zinc Content of Ores and Concentrates
Monthly average tonnage through Oct. 1951- Averages for 1950 in parentheses
CANADA
METAL 7,102 (9,104)
ORE 6,904 (5,496)
METAL 142 (2)
AUSTRALIA
FAR EAST
ORE 221 (168)
METAL 107 (44)
U.S.A. MONTHLY AVERAGE METAL PRODUCTION FOR 1951 (77,650) (1950) (75,860)
METAL 165 (1623)
ORE 687 (1256)
METAL 1824 (893)
U.K. EUROPE AFRICA INDIA
1951 tonnages indicated by width of arrow
0 10,000 20,000
SCALE IN TONS
METAL 63 (2292)
ORE 14,066 (12,380)
METAL 337 (136)
MEXICO-CENTRAL & SOUTH AMERICA

Zinc

Production of slab zinc by United States smelters in 1952 likely to exceed million-ton mark, surpassing all-time peak.

CHARLES R. INCE, Vice President, St. Joseph Lead Co., New York

IN THE ZINC MARKET, 1951 had many of the earmarks of a World War II year. Price controls, restrictions in use and finally government allocation of the entire supply occurred in fairly rapid succession and by the year's end the zinc mining, smelting and consuming industries were operating largely under government direction. But the resemblance ends there. Whereas in World War II the world supply and the market could be controlled by the Combined Raw Materials Board of the Allied Nations, owing to the isolation of European countries, there was a "free market" outside of the United States in 1951, responsive to the law of supply and demand, in which metals sold as high as 30¢-40¢ per lb. as compared to a U. S. controlled price of 17.5¢ which prevailed for the first nine months. The inevitable result of this disparity was the diversion of metal and concentrate imports, on which we are dependent for about one-third of our supplies, to the higher world market.

With the United States and United Kingdom accounting for 60% of the free world's consumption and both countries operating under controlled economies, the premiums paid in the world market were somewhat surprising and may be attributed in part to other than a normal industrial demand. There were indications that zinc, along with other base metals, was being used as a hedge against weakening foreign currencies, as evidenced by the fact that the apparent increase in consumption of several European countries exceeded the improvement in industrial activity in those countries. Furthermore, there were strong probabilities that some of the buying in the European market was for the account of countries behind the Iron Curtain.

Conditions Abnormal Here in 1951

In this country, despite a peak smelter production of around 930,000 tons, only surpassed in the war year of 1943, there was every evidence of an increasingly short supply. Loss of imports due to the higher world price, plus inflation of requirements as fears of shortages developed, led to a demand that could not be satisfied under the abnormal conditions which existed. The fact remains, however, that the

Table I.—Supply and Use of Zinc

(IN TONS OF 2000 POUNDS)

	1948		1949		1950		1951*	
SUPPLY (Slab Zinc Basis)								
Supply — Total U. S. mine production, Recoverable Zinc	629,977		593,203		623,375		686,000	
To zinc oxide, lithopone & sulphate — from domestic ore (Zn cont.)	107,159		72,624		104,885		100,000	
Balance to smelters		522,818		520,579		518,510		586,000
Redistilled secondary produced (excluding remelt)	82,320		55,041		60,970		46,000	
Remelt	10,988	73,308	9,722	63,763	16,775	77,745	10,000	56,000
Imports: Ore used by smelters — Recoverable zinc	249,798		223,328		255,178		280,000	
Slab zinc: Duty paid; entered free; and withdrawn	92,494		125,564		155,331		90,000	
Total Imports		342,292		348,892		410,507		370,000
Changes in Inventories: Concentrates at smelter (85% Zn cont.)	D 23,649		D 57,517		D 29,392		D 18,700	
Slab at smelters	D 47,799		I 73,373		D 65,337		I 15,000	
Slab in transit	I 2,548		I 219		I 2,068		D 4,500	
Slab at customers' plants	I 15,035	D 54,965	D 14,083	I 1,992	D 21,452	D 134,083	D 20,000	D 9,500
Unknown Supply — By difference		—		—		22,942		D **20,300
Total slab zinc supply		992,483		931,242		1,163,697		1,001,200
USE								
Consumption of slab zinc (Domestic consumption)								
Galvanizing	370,909		350,880		441,686		373,730	
Brass products	109,140		85,534		139,373		162,269	
Zinc base alloy	234,628		202,181		280,327		276,563	
Rolled zinc	76,672		55,200		68,444		68,644	
Zinc oxide	15,657		10,292		19,187		40,298	
Chemical products	10,689		7,754		9,917		40,298	
Total representing 98%	817,735		711,841		967,134		—	
Total representing 100%		851,807		741,501		1,007,432		919,400
Remelt produced (line 5) and presumably consumed		7,847		6,328		7,740		—
Unknown consumption — By difference		3,552		6,930		—		—
Total slab zinc consumed		863,206		754,759		1,015,172		—
Government account	57,598		91,826		129,258		40,547	
Government account slab zinc imports	2,596	60,194	21,755	113,281	—	129,258	—	40,547
Exports: Ore, concentrates and dross	3,547		—		—		—	
Ore and concentrates	—		2,925		1,146		—	
Scrap — ashes, drosses and skimmings	—		1,570		6,212		—	
Slab	65,536	69,083	58,707	63,202	12,917	20,275	41,300	41,300
Total slab distributed		992,483		931,242		1,163,697		1,001,200

* Preliminary

** Approximately this quantity — recoverable zinc to stockpile on to't.

available supply of zinc to consuming industries in the United States was not too much below the peak of 1950, less than 10%, and was substantially better than 1949, as shown in Table 1. The pinch, where it has developed, has been primarily due to a re-distribution of supplies resulting from the dislocations of a "guns and butter" economy. Those industries having a higher percentage of direct or indirect military orders received a larger proportion of available zinc than those whose outlets lay in the civilian markets.

For example, both the galvanizing and die-casting industries, normally the two largest consumers of zinc, declined 18% and 6% respectively, whereas the brass industry, with military orders running as high as 50% in the last quarter, increased consumption by 13%. These three industries account for nearly 90% of the zinc consumption of the country and, while there was some readjustment of the tonnages consumed in 1951, they held the same relative position. Galvanizing with 374,000 tons, used 41% of the available zinc as compared to 46% the previous year. Die casting and zinc-base alloys with 277,000 tons, accounted for 30% of the supply, roughly the same as the previous year. Brass and bronze products consumed 162,000 tons or 18% of the total supply, compared to 14% in 1951. Rolling mills, zinc oxide and other uses totaling 107,000 tons, accounted for the remainder of around 10% and were substantially unchanged from the previous year percentagewise.

As to the future requirements of

Table II.—Total Slab Zinc Smelter Output (All Grades) 1948-1951, Short Tons

	(1) Stock Beginning	(2) Production	(3) SHIPMENTS Domestic	(4) Export & Drawback	(5) Gov't Acct.	(6) Total	(7) Stock at End	(8) Unfilled Orders at End	(9) Daily Avg. Prod.
1948	68,647	850,105	770,396	69,910	57,696	897,904	20,848	51,318	2,323
1949	20,848	870,113	648,295	56,929	91,826	796,740	94,221	42,925	2,384
1950	9,255	910,354	849,240	18,199	129,258	995,691	8,884	74,796	2,580
1951									
Jan.	8,884	80,937	72,068	3,158	4,385	79,609	10,212	72,770	2,611
Feb.	10,212	70,285	64,784	2,316	2,280	69,380	11,117	78,448	2,510
Mar.	11,117	80,450	70,845	5,916	3,701	80,462	11,105	80,789	2,595
April	11,105	77,882	69,125	2,473	2,821	74,419	14,548	77,293	2,595
May	14,548	80,430	73,093	1,434	3,040	77,567	17,411	73,942	2,595
June	17,411	77,679	74,149	1,911	3,239	79,299	15,791	73,304	2,589
July	15,791	78,955	79,481	3,020	3,845	85,346	11,400	82,412	2,547
Aug.	11,400	74,035	69,896	3,200	2,295	74,191	11,244	82,867	2,397
Sept.	11,244	70,823	58,436	3,144	3,082	64,632	17,235	66,838	2,354
Oct.	17,235	79,432	68,365	2,167	3,061	73,583	23,084	66,293	2,562
Nov.	23,084	79,376	70,064	4,517	2,818	77,419	25,041	67,268	2,646
Dec.	25,041	81,769	72,614	8,813	3,292	84,909	21,901	60,509	2,638
		931,833	835,920	42,067	40,829	918,816			
Monthly Average		77,653	69,643	3,506	3,402	76,568		Daily Average	2.85

these industries, there was some evidence as the year ended that they would not be as great as in the last two years. Consumption of industrial commodities such as zinc is reflected quite clearly in industrial production. The Federal Reserve Board's industrial output index for November (latest figure) stood at 218. Last April it was 223. Furthermore, the December reports of the National Association of Purchasing Agents on general business conditions were not encouraging. The number of members reporting lower order backlogs was the largest since July-August.

1951 Slab Output Near Peak

On the supply side, the domestic slab zinc production in 1951 of about 930,000 tons was not too far off from the all-time peak of 990,000 tons reached in the war year of 1943. It is estimated that over 1-million tons can be produced in 1952 if concentrates are available. As to concentrate supplies, domestic mine production in 1951 totaled about 675,000 tons of recoverable zinc. However, at year end, with the incentive of higher prices, 60,000 tons per month were coming out of domestic mines, indicating a probable availability from this source in 1952 of 725,000 to 750,000 tons. Likewise, imports of both concentrates and slab zinc were improving as 1951 ended. With indications that world concentrate requirements may approach a balance in 1952, there is every likelihood that U. S. smelters will receive the necessary raw materials to achieve the 1-million ton all-time peak production. World reserves of zinc have increased substantially in the last 20 years. As recently as October, 1951, at an Institute of Metals meeting in London, it was estimated that these reserves have risen to at least 40 years' life as compared to a 22½-year reserve in 1931.

The International Materials Conference in allocating the free world zinc supply has allowed 252,000 tons for the United States in the first quarter. Assuming that allocations materialize as planned and there is no reduction in subsequent quarters, the amount indicated would make available to U. S. consuming industries over 1-million tons in 1952, substantially higher than the 920,000 available to consumers in 1951. All things considered, there is every prospect that for the foreseeable future zinc supplies will be adequate. This should be reassuring to zinc consumers.

Tin

Sharp rise in price early in 1951 sets off retaliatory action by U.S. Stockpile purchases end. Government in control; becomes sole importer and distributor.

H. H. WANDERS
Market Editor

THE GOVERNMENT became the sole buyer and seller of tin in the United States market and in this strong position, wielded unlimited power over all concerned in an effort to establish a "fair price." In the ensuing struggle producers were hit by the forced sharp slump in prices, and consumers had to get along with reduced supplies in the face of an actual surplus in production.

That the market was heading for trouble became apparent when the panic buying, growing out of the Korean incident, carried prices to dizzy heights. In Singapore, where violent price changes occurred almost daily on the tenor of news from Korea, the top grade of tin climbed to the equivalent of $1.93 per lb. London was almost as bad. The high in New York was $1.83, the price holding at that level partly because of the general price freeze announced in January by the Office of Price Stabilization. The price freeze temporarily halted trading in tin futures on the Commodity Exchange.

Use of tin after January was restricted by the National Production Authority to 80% of the base period, the average monthly use in the first half of 1950.

The rise and fall of prices that took place in 1950 and 1951 will go down in the history of the tin market as the most sensational on record. The monthly averages for Straits quality tin in New York, *E&MJ* quotations, which follow, tell the story:

Straits Tin, New York
(Cents Per Pound)

	1950	1951
January	76.070	171.779
February	74.352	182.716
March	75.694	145.808
April	76.430	145.735
May	77.495	139.923
June	77.688	117.962
July	89.715	106.000
August	102.194	103.000
September	101.250	103.000
October	113.420	103.000
November	137.217	103.000
December	144.940	103.000
Average	95.539	127.077

Enmeshed in a pattern of worldwide inflation and grave uncertainty over whether the Korean incident would spread, traders in tin bid for supplies regardless of consequences. Warnings that something would have to be done about the runaway market went unheeded. Consumers in this country soon calmed down on indications that the government would step into the market and check the rise. The RFC made tin available here at average prices. It was not until rumors began circulating abroad late in February to the effect that the United States intended to end its stockpiling activities and move toward complete control over tin in this market, that the market began to waver.

On March 5, a subcommittee of the Senate Armed Services Committee, reporting on the tin situation, recommended that the United States should stop purchasing tin for its stockpile to force down the price to a more reasonable level.

Senator Lyndon B. Johnson of Texas, chairman of the Committee, declared: "The tin price-gouging by some of our oldest international friends is entirely devoid of morality. The United States needs tin, but we don't need it so badly that we must bankrupt ourselves by paying anything and everything other nations try to charge. Our Committee believes that the government agencies buying tin ought to stop their purchases until the tin prices return to a sensible level."

On receiving this directive from the Committee, the General Services Administration ceased purchasing tin for the stockpile. The National Production Authority took

E & M J Annual Average Metal Prices — 1897 to 1951

Year	COPPER, (a) Electrolytic Refinery	LEAD, Common, N. Y.	ZINC, Prime Western (b) E. St. Louis	TIN, (c) N. Y.	SILVER, (e) N. Y.	QUICKSILVER, (f) N. Y.
1897.....	11.29	3.580	4.120	13.87	59.790	38.50
1898.....	12.03	3.780	4.670	15.70	58.280	40.70
1899.....	16.67	4.470	5.750	28.12	59.560	43.63
1900.....	16.19	4.370	4.390	29.90	61.330	51.00
1901.....	16.11	4.330	4.070	16.74	58.960	47.00
1902.....	11.028	4.069	4.940	26.79	52.180	48.03
1903.....	13.235	4.237	5.191	29.09	53.570	41.32
1904.....	12.823	4.309	4.931	27.99	57.221	41.00
1905.....	15.590	4.707	5.730	31.356	60.352	38.50
1906.....	19.279	5.657	6.048	39.819	66.791	40.90
1907.....	20.004	5.525	5.812	38.166	65.237	41.50
1908.....	13.208	4.200	4.576	29.465	52.984	44.84
1909.....	12.982	4.273	5.382	29.725	51.502	46.30
1910.....	12.738	4.446	5.376	34.123	53.466	47.06
1911.....	12.378	4.420	5.008	42.281	53.340	46.54
1912.....	16.341	4.471	6.799	48.066	60.836	42.48
1913.....	15.289	4.370	5.504	44.252	59.791	39.54
1914.....	13.802	3.962	5.061	34.301(d)	54.811	48.31
1915.....	17.275	4.673	13.054	38.580	49.684	87.01
1916.....	27.202	6.958	12.634	43.480	65.661	125.49
1917.....	27.180	8.767	8.813	61.802	81.417	106.30
1918.....	24.628	7.413	7.890	68.750	99.772	123.47
1919.....	18.691	5.799	6.988	63.328	111.122	92.15
1920.....	17.456	7.957	7.671	48.273	100.900	81.12
1921.....	12.502	4.545	4.655	29.918	62.654	48.46
1922.....	13.382	5.734	5.716	32.554	67.828	58.95
1923.....	14.421	7.267	6.607	42.664	64.673	66.90
1924.....	13.024	6.087	6.344	50.176	66.781	69.76
1925.....	14.042	6.020	7.622	57.863	69.065	83.13
1926.....	13.796	6.417	7.337	65.285	62.107	91.90
1927.....	12.920	6.755	6.242	64.353	58.370	119.16
1928.....	14.570	6.305	6.027	50.427	58.176	123.51
1929.....	18.107	6.633	6.512	48.155	52.993	122.18
1930.....	12.962	5.517	4.558	31.694	38.154	115.01
1931.....	8.116	4.243	3.940	24.487	28.700	87.35
1932.....	5.565	3.180	2.878	22.017	27.892	87.93
1933.....	7.925	3.869	4.029	39.110	34.727	99.23
1934.....	8.429	3.880	4.158	52.191	47.973	73.87
1935.....	8.840	4.065	4.328	50.420	64.273	71.99
1936.....	9.474	4.710	4.901	48.441	45.087	79.92
1937.....	13.167	6.009	6.019	54.337	44.883	90.18
1938.....	10.000	4.739	4.610	42.301	43.225	75.47
1939.....	10.965	5.053	5.110	50.323	39.082	103.94
1940.....	11.296	5.179	6.335	49.827	34.773	176.98
1941.....	11.797	5.793	7.474	52.018	34.783	185.02
1942.....	11.775	6.481	8.250	52.000	38.333	186.35
1943.....	11.775	6.500	8.250	52.000	44.750	195.21
1944.....	11.775	6.500	8.250	52.000	44.750	118.36
1945.....	11.775	6.500	8.250	52.000	51.926	134.89
1946.....	13.826	8.109	8.276	54.544	80.151	98.24
1947.....	20.958	14.673	10.509	77.949	71.820	83.74
1948.....	20.038	18.043	13.589	99.250	74.361	78.40
1949.....	19.202	15.364	12.144	99.336	71.930	79.48
1950.....	21.235	13.296	13.866	95.539	74.199	81.28
1951.....	24.200	17.500	16.000	127.077	90.388	210.13

(a) Lake copper 1897-98; domestic market since 1932. (b) New York delivery 1898-1902. (c) 99 percent tin 1897 to 1920, inclusive; Straits quality thereafter. (d) Average for eleven months. (e) New York market. All quotations in cents per lb., except for silver, which are in cents per troy oz., and (f) quicksilver which are in dollars per flask of 76 lb.

E & M J Weekly Average Metal Prices — 1951

	COPPER — Domestic, Refinery	COPPER — Export, Refinery	LEAD N. Y., Common	ZINC E. St. Louis Prime Western	TIN N. Y., "Straits"	SILVER N. Y., Foreign	QUICKSILVER N. Y.
Jan. 3	24.200	24.425	17.000	17.500	151.000	90.000	144.00
Jan. 10	24.200	24.425	17.000	17.500	160.167	87.620	165.00
Jan. 17	24.200	24.425	17.000	17.500	174.333	90.160	185.00
Jan. 24	24.200	24.425	17.000	17.500	176.792	90.160	225.00
Jan. 31	24.200	24.425	17.000	17.500	182.583	90.160	220.00
Feb. 7	24.200	24.425	17.000	17.500	182.500	90.160	216.00
Feb. 14	24.200	24.425	17.000	17.500	182.700	90.160	215.00
Feb. 21	24.200	24.425	17.000	17.500	183.000	90.160	215.00
Feb. 28	24.200	24.425	17.000	17.500	182.650	90.160	215.00
Mar. 7	24.200	24.425	17.000	17.500	178.833	90.160	215.00
Mar. 14	24.200	24.425	17.000	17.500	135.000	90.160	210.00
Mar. 21	24.200	24.425	17.000	17.500	134.000	90.160	210.00
Mar. 28	24.200	24.425	17.000	17.500	134.000	90.160	210.00
April 4	24.200	24.425	17.000	17.500	149.500	90.160	210.00
April 11	24.200	24.425	17.000	17.500	150.229	90.160	210.00
April 18	24.200	24.425	17.000	17.500	145.333	90.160	215.00
April 25	24.200	24.425	17.000	17.500	142.000	90.160	215.00
May 2	24.200	24.425	17.000	17.500	142.000	90.160	215.00
May 9	24.200	24.425	17.000	17.500	142.000	90.160	215.00
May 16	24.200	24.425	17.000	17.500	139.000	90.160	212.00
May 23	24.200	25.038	17.000	17.500	139.000	90.160	212.00
May 30	24.200	27.250	17.000	17.500	139.000	90.160	212.00
June 6	24.200	27.383	17.000	17.500	136.500	90.160	210.00
June 13	24.200	27.250	17.000	17.500	129.167	87.750	210.00
June 20	24.200	27.403	17.000	17.500	109.867	87.750	210.00
June 27	24.200	27.413	17.000	17.500	106.000	87.750	210.00
July 4	24.200	27.425	17.000	17.500	106.000	90.160	210.00
July 11	24.200	27.425	17.000	17.500	106.000	90.160	210.00
July 18	24.200	27.425	17.000	17.500	106.000	90.160	210.00
July 25	24.200	27.425	17.000	17.500	106.000	90.160	206.00
Aug. 1	24.200	27.425	17.000	17.500	106.500	90.160	206.00
Aug. 8	24.200	27.425	17.000	17.500	103.000	90.160	196.00
Aug. 15	24.200	27.425	17.000	17.500	103.000	90.160	196.00
Aug. 22	24.200	27.425	17.000	17.500	103.000	90.160	196.00
Aug. 29	24.200	27.425	17.000	17.500	103.000	90.160	196.00
Sept. 5	24.200	27.425	17.000	17.500	103.000	90.160	196.00
Sept. 12	24.200	27.425	17.000	17.500	103.000	90.160	196.00
Sept. 19	24.200	27.425	17.000	17.500	103.000	90.160	207.00
Sept. 26	24.200	27.425	17.000	17.500	103.000	90.160	218.00
Oct. 3	24.200	27.425	17.000	18.300	103.000	90.160	215.00
Oct. 10	24.200	27.425	19.000	19.500	103.000	87.350	215.00
Oct. 17	24.200	27.425	19.000	19.500	103.000	88.000	218.00
Oct. 24	24.200	27.425	19.000	19.500	103.000	88.000	218.00
Oct. 31	24.200	27.425	19.000	19.500	103.000	88.000	219.00
Nov. 7	24.200	27.425	19.000	19.500	103.000	88.000	218.00
Nov. 14	24.200	27.425	19.000	19.500	103.000	88.000	218.00
Nov. 21	24.200	27.425	19.000	19.500	103.000	88.000	215.00
Nov. 28	24.200	27.425	19.000	19.500	103.000	88.000	215.00
Dec. 5	24.200	27.425	19.000	19.500	103.000	88.000	215.00
Dec. 12	24.200	27.425	19.000	19.500	103.000	88.000	215.00
Dec. 19	24.200	27.425	19.000	19.500	103.000	88.000	212.00
Dec. 26	24.200	27.425	19.000	19.500	103.000	88.000	212.00

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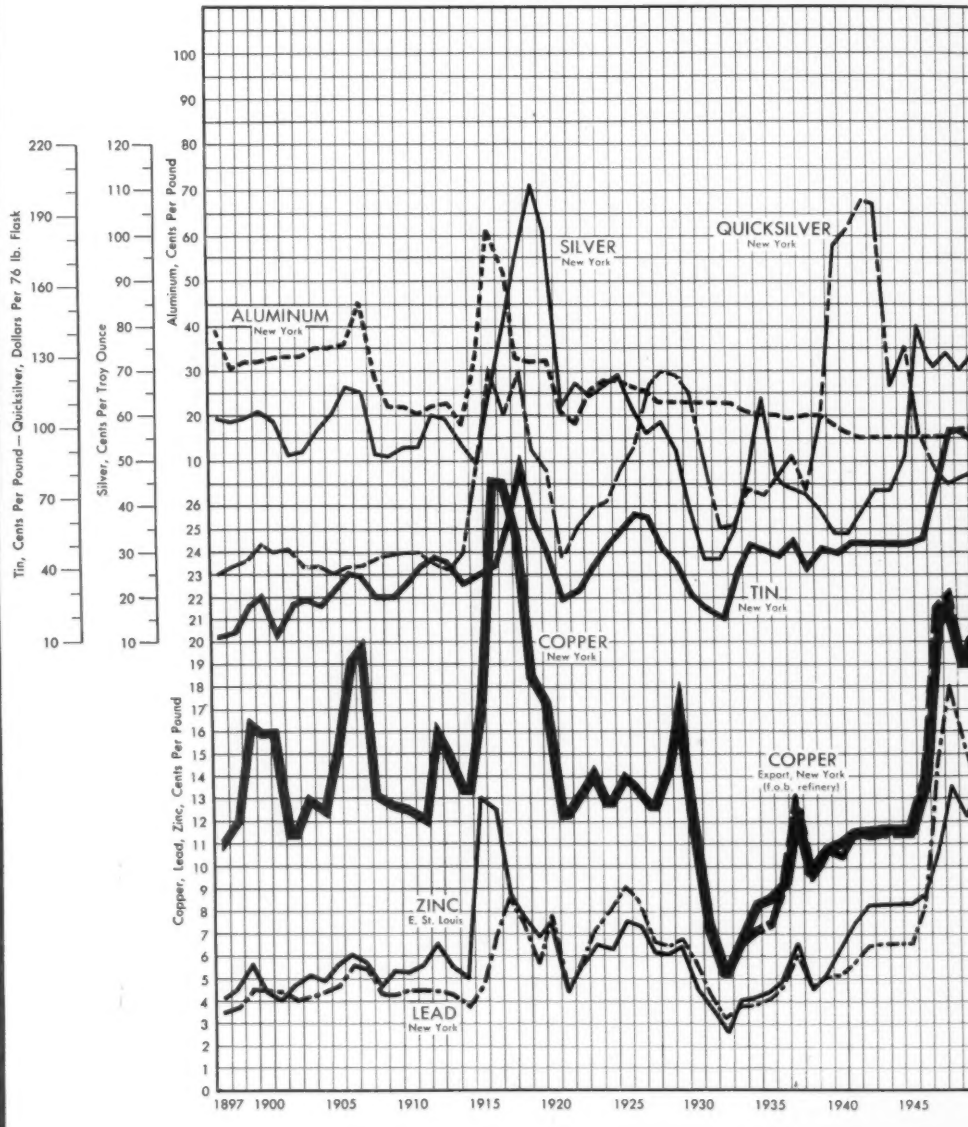
Annual Averages — 1897-1951

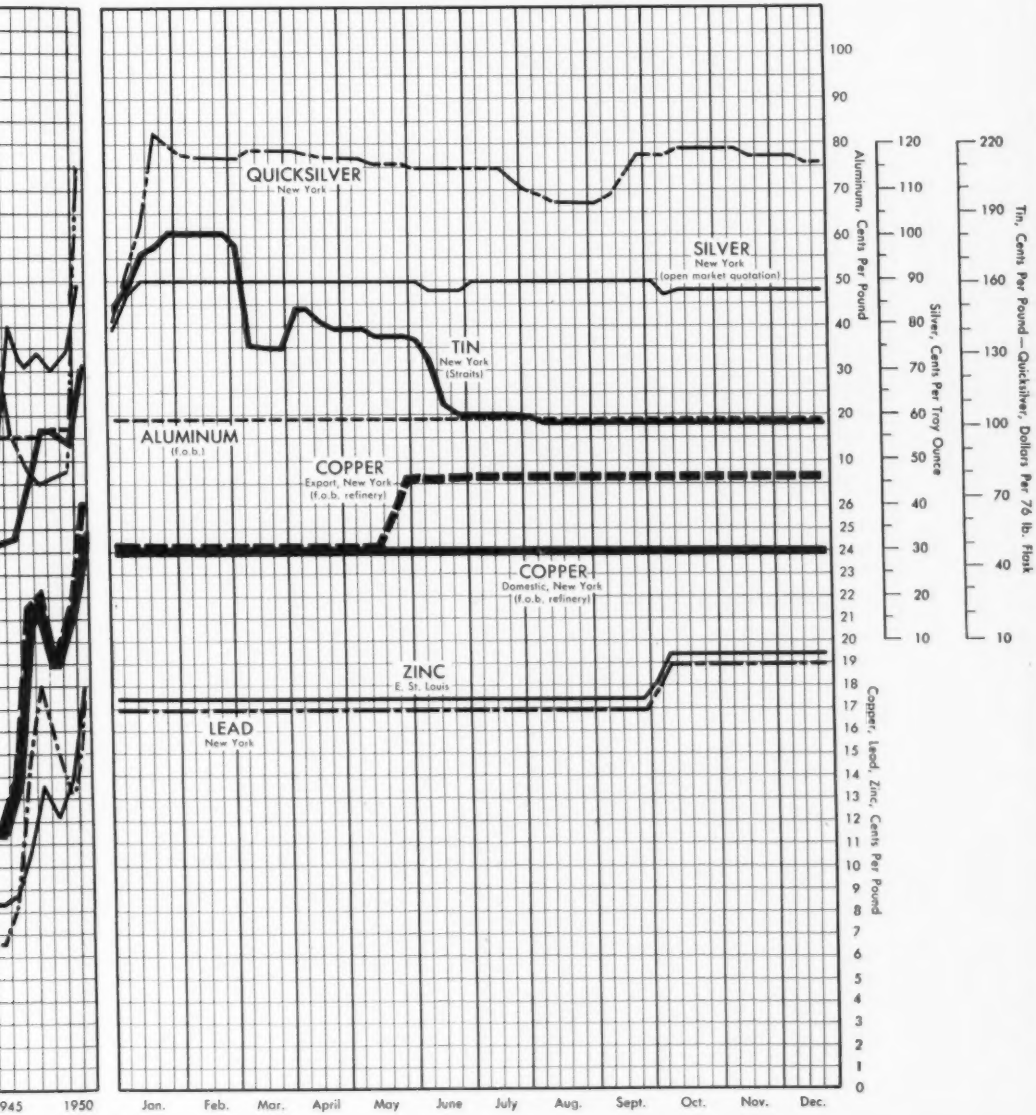


Metal Prices

Journal and E & M J Metal and Mineral Markets

lishing Company, Inc., New York

Weekly Averages — 1951



over all importation of tin and announced that distribution of tin through allocation to consumers would commence May 1.

The RFC sold tin to domestic consumers at declining prices, realizing less on the metal than the going world price established in Singapore. The decline continued until the beginning of August when the price here was established at $1.03 per lb.

Producers, with few exceptions, admit that the rise in prices was excessive and had its origin largely in scarce buying. But they were certain that the decline in the price that resulted from the pressure exerted by this government also was excessive. Consumers, whose immediate concern was to maintain production of cans and other products containing tin, favored a general settlement of the pricing problem at a higher level than that named by RFC in August to September. In fact, they hoped for a resumption of buying "at the best price possible," arguing that a higher price than $1.03 would affect the cost of their products only slightly. It was common knowledge in tin circles that a price of $1.25 per lb. and even higher would be acceptable under prevailing conditions.

Tin Output Maintained

In spite of rising costs, labor difficulties, and Communist terrorism in the tin areas of the Far East, production at the mines in 1951 was maintained at about the same level as in 1950. World mine output for 1951 was estimated at 164,400 long tons, and compares with 167,000 tons in the preceding year. Malaya produced approximately 56,900 tons in 1951, against 57,540 tons in 1950. Indonesia's contribution last year was estimated at 30,800 tons, against 32,100 tons in 1950. Bolivia's mine output (shipments) totaled around 34,300 tons in 1951, against 27,550 tons in the preceding year.

Preliminary estimates placed world pig tin output for 1951 at 166,000 tons, against 171,900 tons in 1950.

World consumption of primary tin in 1951 was estimated at 139,700 tons, against 147,000 tons in the preceding year. The United States consumed approximately 56,700 tons in manufacture during the last year, which compares with 71,191 tons in 1950.

At meetings of the International Tin Study Group, those delegates who represented the producers made little progress in changing the views of representatives from the United States. Though production at the Longhorn (Texas) smelter had to be curtailed because of shrinking stocks of concentrates, and total stocks of tin (metal and metal content of concentrates) in the hands of consumers and the RFC dropped from 72,887 tons at the end of 1950 to 49,482 tons at the end of the third quarter, the authorities in Washington in control of the domestic market stood fast and warned consumers that further limitations on use were planned.

Administrator Symington, whose adamant stand on prices upset all divisions of the tin industry in 1951, resigned from the RFC early in 1952. Secretary of State Acheson became interested in tin pricing at the request of the Bolivian Government. The visit of Prime Minister Churchill in January resulted in an agreement on raw materials, including tin. These eleventh-hour developments point to an early settlement of the complex pricing problem in tin.

Longhorn Tin Production

Production of pig iron from concentrates at the Longhorn (Texas City) smelter during 1949, 1950, and 1951, by months, in long tons:

	1949	1950	1951
January	3,257	2,627	3,211
February	3,254	2,362	3,096
March	3,104	2,729	3,036
April	2,851	2,484	3,058
May	3,007	2,852	3,059
June	3,006	2,204	2,655
July	2,910	2,256	2,406
August	3,005	2,396	2,543
September	2,910	2,805	2,155
October	2,964	3,209	2,091
November	2,994	3,207	1,806
December	2,791	3,005	1,805
Total	36,053	32,136	30,921

Aluminum

1952 production expected to exceed 1-million tons. No price change took place in 1951.

O. C. SCHMEDEMAN*, Chief Geologist, Irving Lipkowitz, Assistant to President, Reynolds Metals Co.

DOMESTIC PRIMARY ALUMINUM producers achieved a new peacetime record in 1951, with an output estimated at 840,000 tons, 17% greater than in 1950 and surpassed only by the World War II peak of 920,000 tons in 1943. The current extraordinary expansion of capacity is expected to boost 1952 production over the 1-million-ton mark.

Primary aluminum imports fell off sharply, from 176,000 tons in 1950 to an estimated 125,000 tons in 1951, due to Canada's drastically reduced shipments to this country. During 1950 about 44% of Canada's output was shipped to the United States in primary form but in 1951 only 23% of its output came here, 62,000 tons less. Total primary aluminum supply, domestic production plus imports, was 965,000 tons in 1951; 891,000 in 1950.

Aluminum alloys recovered from scrap were also greater in 1951, totaling about 290,000 tons, 19% more than in 1950. This was primarily the result of the heavier generation of new scrap in domestic fabricating plants. In 1950 about two tons of new scrap were used to every ton of old scrap. In 1951 about three tons of new scrap were used to every ton of old scrap. Scrap imports were substantially below 1950 levels and for some weeks during the second half of the year the flow of scrap to smelters, foundries and all other users dwindled seriously.

Domestic production of primary and scrap aluminum more than offset the shrinkage in imports, the total combined supply for 1951 being 1,255,000 tons as compared with 1,135,000 tons in 1950.

The bauxite supply, domestic and imported, is keeping pace with the increased requirements of the aluminum producers. Domestic mine production increased sharply during 1951, about 35% above 1950 and 60% above 1949. The rise in bauxite imports was more gradual, about 12% greater than

* Died Dec. 4, 1951.

in 1950 and 5% higher than in 1949. As a consequence, domestic mines accounted for 40% of the supply in 1951 as against only 30% of the 1949 supply.

Although part of the available supplies was delivered to the military stockpile, the volume of fabricated aluminum shipments was running 5% higher for the first ten months of 1951 than for the same period in 1950—a record peacetime year. However, sheet and strip shipments were about 5% less in 1951 than in 1950. Castings shipments were slightly higher in 1951, by about 3%. But rolled rod, bar and wire shipments were 27% higher and shipments of extruded products were 26% higher.

The 1951 shipments of fabricated aluminum are seen in better perspective when they are compared with a more representative postwar period, such as the average shipments during the three prior years, 1948 through 1950. See Table 1.

Most significant development of 1951 was the domestic capacity expansion. This program, initiated late in 1950, was more than doubled during 1951, from 320,000 tons to 725,000 tons of additional capacity. Two of the new units built under this program are already in production and the rest of the new units are expected to go into operation during 1952 and 1953.

To supplement new primary aluminum producing facilities, producers are building plants to refine bauxite into alumina. All present alumina plants of major producers are being enlarged. New alumina plants are also being built by Alcoa at Bauxite, Ark., and by Reynolds at Corpus Christi, Tex.

Bauxite mining operations are being increased in Arkansas and Dutch Guiana, South America. New sources of bauxite are also being rapidly developed by Reynolds and Kaiser in Jamaica, less than half as distant from United States ports as the Dutch Guiana deposits. Mining, processing and transportation facilities and a deep-water pier are expected to be completed by Reynolds about April, 1952 and the Kaiser project, including the same range of facilities, is scheduled for operation around September, 1952.

The current expansion program undertaken by the domestic producers is unique in many respects. All of the current 725,000-ton capacity expansion (including auxiliary alumina and power facilities) has thus far been privately financed by the producers, requiring expenditures of about $700-million. During World War II less than half as much, 304,000 tons, of new capacity was built privately. Current expansion by the industry also exceeds the Government's World War II expansion program of 670,000 tons.

New capacity built by producers since World War II and expansion now taking place are expected to be permanent additions to the nation's aluminum producing facilities, able to operate economically under ordinary business conditions. By contrast, 60% of the Government's

Table 1. Increase in 1951* Shipments of Fabricated Aluminum over Three-Year Average for 1948-1950**

Class of product	Thousands of tons	Percent
Total all fabricated products	270.2	17
Sheet and strip	17.7	2
Castings	49.8	15
Rolled (rod, bar, wire, etc.)	96.4	53
Extruded (shapes, tubing, etc.)	106.3	67

* First 10 months.

** First ten months of each year.

Table 2. Primary Aluminum Capacity in the United States

Company and Plant Location	In Operation December 1951	To Be Completed In 1952 and 1953	Total
	(Thousands of Tons)		
Aluminum Company of America			
Regular Operation			
Alcoa, Tenn.	145.3		145.3
Vancouver, Wash.	76.1		76.1
Massena, N. Y.	57.5		57.5
Point Comfort, Tex.	57.0	35.0	92.0
Badin, N. C.	33.9		33.9
Wenatchee, Wash.		85.0	85.0
Rockdale, Tex.		85.0	85.0
Total—Regular	369.8	205.0	574.8
Temporary Operation*			
Badin, N. C.	9.5		
Massena, N. Y.	14.5		
St. Lawrence, N. Y.	55.0		
Total—Temporary	79.0		79.0
Total—All Plants	448.8	205.0	653.8
Reynolds Metals Company			
Jones Mills, Ark.	97.0		97.0
Troutdale, Ore.	82.5		82.5
Listerhill, Ala.	50.0		50.0
Longview, Wash.	31.5	18.5	50.0
Corpus Christi, Tex.		80.0	80.0
New Arkansas Plant		55.0	55.0
Total	261.0	153.5	414.5
Kaiser			
Mead, Wash.	150.0	20.0	170.0
Tacoma, Wash.	25.0		25.0
Chalmette, La.		200.0**	200.0
Total	175.0	220.0	395.0
Anaconda-Harvey			
Kalispell, Mont.		72.0	72.0
Grand Totals	884.8	650.5	1535.3
Total Regular Capacity (excluding temporary)	805.8	650.5	1456.3

* Alcoa is operating 79,000 tons of capacity (not considered economical for lack of cheap power) under a special contract whereby the Government pays power costs in excess of 5 mills per kwh.

** Initial unit went into operation in December 1951.

World War II expansion was in the "war baby" category, lacking adequate sources of economical power. Consequently, about 35% of the Government's World War II capacity was cannibalized after the war, another 16% had to be dismantled and relocated by private producers and 8% of that capacity is being operated on a temporary basis with the Government absorbing the excessive power costs.

The magnitude of the burden undertaken by producers is not fully revealed by statistics of new capacity. With the coming of huge public power developments such as TVA and Bonneville, during the Thirties, the bulk of the economical aluminum plant expansion just prior to and during World War II could be based on purchased hydro power from these sources. But after the outbreak of Korea, producers found that to get new aluminum capacity into production rapidly, they would have to build their own power plants. Thus, 63% of the capacity to be completed in 1952 and 1953 will have its own power generating plants. The other 37% of new capacity will use energy purchased from private and public power companies.

In the construction of this new capacity there is a marked shift away from hydroelectric power. Prior to World War II this country's aluminum plants relied 100% on hydroelectric power to supply huge power requirements. Of the 632,500 tons of new capacity to be completed in 1952 and 1953, only 28% will use hydro power, and 72% will get electrical energy made from gas or lignite.

Another feature of the expansion program is the participation of a new producer, a joint venture of the Anaconda Copper Co. and Harvey Machine Co., which received Government approval in December. The entry of the Anaconda-Harvey group brings the number of domestic producers to four. Previously, Reynolds Metals had become the country's second producer in 1941 when it completed producing plants in Alabama and the State of Washington. Kaiser Aluminum and Chemical became the nation's third producer when, in 1946, it leased Government World War II plants. When the current expansion program is completed in 1953, relative shares of the regular primary aluminum capacity held by the four producers will be:

Alcoa	39%
Reynolds	29
Kaiser	27
Anaconda-Harvey	5

As far as can be ascertained, the capacity expansion taking place in the United States is greater by a very wide margin than that of any other country and probably exceeds the combined expansion of the rest of the world. Canada, second ranking producer, expects to increase capacity 44,000 tons or 9% by 1953 as against the 725,000-ton or 100% expansion which will be realized in this country.

Markets and Prices

The aluminum industry did not increase prices on the major industrial types of aluminum products. Primary metal in pig form was still selling at 18¢ per lb. at the end of 1951, 10% below the 1939 price. The market for aluminum was very strong throughout the year. The 17% increase in domestic production proved insufficient to meet rapidly rising military requirements plus constantly widening civilian demand. Early in the year, Government controls limited civilian usage to 65% of a 1950 base period. When the CMP system of material allocations was brought back into operation, aluminum was covered along with copper and steel. As a result of the military need to get larger amounts of metal, the ceiling on civilian uses was steadily lowered during 1951. For the first quarter of 1952, the ceiling for many civilian products is 20% of the 1950 base period.

The increasing difficulty of getting aluminum for civilian uses during 1951 has not diminished industry's interest in the metal. The automotive industry is turning to aluminum for many component parts because of performance and maintenance advantages and savings in raw material and fabricating costs. Roy W. Johnson, General Electric executive vice president in charge of the appliances and electronics division, emphasized in a public statement that "Aluminum is now an alternate and not a substitute for copper in General Electric appliance manufacturing." A clue as to whether this shift is intended to be permanent or a shortage expediency is Mr. Johnson's further comment that "In most instances we will never go back to materials for which we have found workable alternates." In the heavy electrical apparatus field, General Electric also reports a switch from copper to aluminum.

Technological developments in the application of aluminum are being accelerated by current military program just as they were by every military program since World War I. As in the past, these new techniques and new alloys are expected to broaden the areas of civilian use in future years. Consequently, though the civilian shortage is expected to be severe in 1952, industry leaders are optimistic about the continued and rapid growth of the industry.

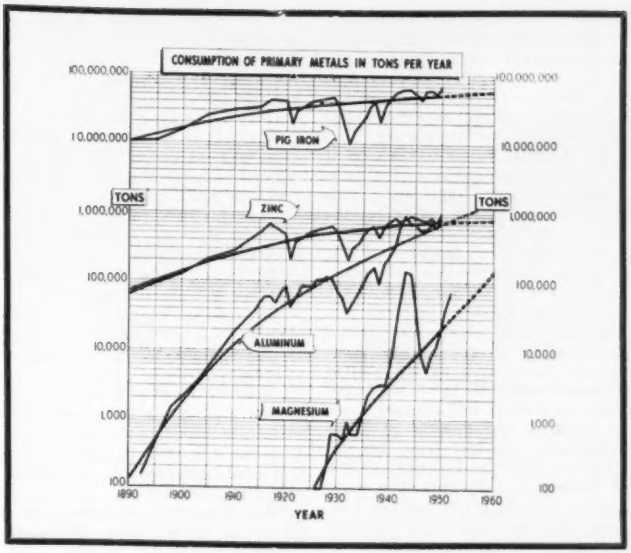
Magnesium

Magnesium production to surpass World War II peak. No price change took place in 1951.

DR. J. D. HANAWALT, Manager Magnesium Department, The Dow Chemical Co.

ONE OF THE MORE SIGNIFICANT EVENTS in the history of the magnesium industry in the United States is the fact that growth of magnesium since the Korean conflict has been but the continuation of a very satisfactory growth in the three preceding peacetime years. This brief period of a few years between military activity has seen a rapid growth of magnesium in commercial uses. Also significant is the increase in magnesium-wrought products (sheet and extrusions) as compared with magnesium castings. Monthly shipments of magnesium castings in the United States, more than 70% of which were for military use, increased 63% in the three years previous to Korea, while wrought products, about 80% of which were commercial items, increased 314% in the same period. Since Korea, military consumption is again on top.

The fact that magnesium-wrought



products sold in the United States exceeded magnesium castings for the first time in 1951 is a sign that magnesium is coming of age. It is now possible to foresee the future of the industry. Note the accompanying growth curves of four major metals from 1890 to 1960. Consumption curves of iron and zinc are leveling off. Aluminum, older brother in the "light metal" industry, got its start some 35 years before magnesium, but is still growing vigorously; in fact, has passed zinc.

Metal availability and important technological developments can greatly affect an industry and are major factors in determining the slope of the growth curve. Note also peaks and valleys of consumption curves due to transient effects such as wars, booms, and depressions.

Wars affect some metals more than others, as can be seen in the large effect of World War II on magnesium. Note that the projection of what might be considered the most probable growth curve for magnesium indicates an ingot volume of about 150,000 tons in 1960. This does not take into account any war situation which would put a peak in the curve greater than the one in 1943. Even the present military preparedness program is causing an acceleration of consumption.

At present, both military and commercial uses of magnesium are developing. In many cases, they are unrelated but in others the military uses have their counterparts in civilian applications.

Military uses are broadening. In World War I, in 1917, magnesium was used only for flares, and in quantities too small to find on this graph. In World War II, the major uses for the 200,000 tons a year production were incendiary bombs and castings for aircraft engines and wheels. Very little use was made of wrought products. Since 1945, however, new developments have changed the situation again. The magnesium bomb is apparently obsolete. Since 1945 magnesium castings are required in aircraft even more completely; and, in addition, wrought products are now extensively included in the designs. Furthermore, not only the air force, but most of the other military agencies have developed important uses for magnesium, both cast and wrought.

Considering the relatively small use of magnesium *sheet* in World War II, its present use in military aircraft and equipment is significant. This huge B-36 superbomber utilizes more than 10,000 lb. of magnesium sheet in the airframe alone. Another 9,000 lb. of the metal goes into the plane in the engines, wheels, and miscellaneous parts.

With the exception of only a few small areas, the entire fuselage of the 10-passenger Sikorsky-55 helicopter aircraft is magnesium sheet. In addition, 90 castings of magnesium are used in other parts.

It would not be right to imply that magnesium sheet has won so large an acceptance as this on airplanes generally. However, a rocket-propelled plane, the Douglas Skyrocket, flew at a speed unofficially reported in the papers to be more than 1,500 mph. The navy announced that the ship had "attained the highest speed and altitude ever recorded by a piloted plane." Practically the entire fuselage is made from magnesium sheet. Complete magnesium wings are being built by East Coast Aeronautics, which has also designed complete trainer planes in magnesium.

An interesting development is the radar trailer unit of the Ordnance Department, an agency which only a few years ago made little use of magnesium. The 21-ft. trailer is quite completely magnesium—frame, skin, wheels, and even the equipment inside. It is a mobile anti-aircraft fire control unit designed to be moved by land, transported by plane, or floated across the water. Millions of dollars are involved in this project, designed by the Bell Laboratories and Douglas Aircraft, and being built by Western Electric, Glenn L. Martin, and Fruehauf Trailer.

The commercial highway transportation field already constitutes the largest and fastest growing market. More than 30 companies in the United States are fabricating magnesium into trucks and trailers. Other important fields are the materials-handling field and building industry. In the building industry a magnesium concrete form is made of extrusion and plate which is portable, easy to set in place, and resists alkaline exposure. Other essential uses of sheet and extrusions include anodes for protecting iron from corrosion, the printing industry, and industrial equipment and machinery.

Magnesium die castings have an outstanding field of application in the automotive industry. At about 7-million cars a year, even a minor part of a car provides a major market. Magnesium is presently used in cars at a rate of more than 1,000 tons a year. One of the popular cars has 2.6 lb. of magnesium in seven different magnesium parts. Dow die castings alone for cars total 18 different parts and many more parts have been demonstrated. Magnesium's good castability and the savings in machining are factors which make magnesium salable in this highly competitive field.

Increase in magnesium die cast-

ing capacity is accomplished with relative ease by numerous companies putting more machines to work on magnesium. McCulloch Motors Co. of California, for instance, which makes the magnesium chain saw, have installed magnesium die casting machines in their own plant. Dow's die casting plant has been enlarged as have several others.

However, installing modern facilities for rolling sheet is a different problem. This requires a major technological development, but one which Dow has anticipated, and has been working on for some years, demonstrating on larger and larger scale, how magnesium can be rolled on continuous mills.

This year Dow is initiating the first plant at Madison, Ill., for the coil rolling of magnesium sheet. Present magnesium rolling mills process a 100-lb. slab and turn out single sheets weighing much less. The new 84-in. wide hot and cold mills at Madison will process 2,000-lb. ingots into a single coil of sheet. Later additions will give Dow a tandem continuous mill installation.

Large-scale rolling for magnesium requires a large sales volume to support a large investment, and, on the other hand, the reduced costs of a large mill are first needed to develop the volume market. The Dow Chemical Co. took this kind of step on which growth of the magnesium industry depends. This decision was made prior to the Korean crisis, but the plans have been accelerated because of the military preparedness program, and the U. S. Air Force has given this project its full cooperation. The plant is also greatly welcomed by the independent magnesium fabricators of the United States of which there are about 50. They need wider and cheaper sheet to continue the growth of their businesses. As Mr. Doan has described it in his New York Chamber of Commerce talk, this is a good example of the interdependence of small business and large business and of the way things should work in the American free enterprise system.

Uranium

Potential uranium areas greatly expanded. High value of uranium ores attracts new mining companies.

ALVIN W. KNOERR
Associate Editor

THE MOST USEFUL PURPOSE this review of the uranium mining industry can serve is to remind readers that: (1) Uranium is a valuable commodity; (2) It is being discovered in many new areas, and the borders of producing or favorable areas are being constantly expanded by new discoveries; (3) It will pay mining companies large and small to consider participating in the current program of finding, mining, and treating uranium ores with a view to making a profit.

Uranium a Valuable Commodity

Uranium oxide is such a valuable product that tenor of ore might be quoted realistically in ounces (troy) per ton rather than in percent U_3O_8 per ton. For instance in 0.25% ore mined on the Colorado Plateau (5 lb. U_3O_8, or 72.9 oz. per ton), the gross value of the U_3O_8 would be about 29 to 61¢ per oz., depending on whether the producer is entitled to full haulage and production bonus or not. Similarly in Canada, shippers get approximately 27 to 41¢ per oz. depending on grade.

The value of carnotite-type ores on the Plateau varies widely depending on grade. With full production bonus and haulage allowance (100 mi. at 6¢ per ton mi.) the maximum gross value of ore runs from about $13 for 0.1% ore to $85 for 0.5% ore. (See price chart, *E&MJ*, Jan., 1952.) The prices paid for ore including haulage allowances are guaranteed until 1958, bonus payments are guaranteed until Dec. 28, 1954. In addition AEC's price schedules call for payment of V_2O_5 at the rate of 31¢ per lb. provided that the V_2O_5 to U_3O_8 ratio does not exceed 10 to 1. Exceptions are also made for certain high-lime ores and copper-uranium ores where recovery cost of the vanadium is prohibitive due to metallurgical complications. Assuming that an average Plateau ore might run 0.25% U_3O_8 and 2% V_2O_5, the shipper would get an additional $12.40 per ton of ore for the vanadium content making a total of $33.40 to $56.40 per ton depending on whether he was entitled to the initial production bonus and full haulage bonus or not.

Thus far the ratio of V_2O_5 to U_3O_8 in Plateau ores seems to be well below the 10 to 1 limit; in fact ratios as low as 5 to 1 or even 2 to 1 are not uncommon.

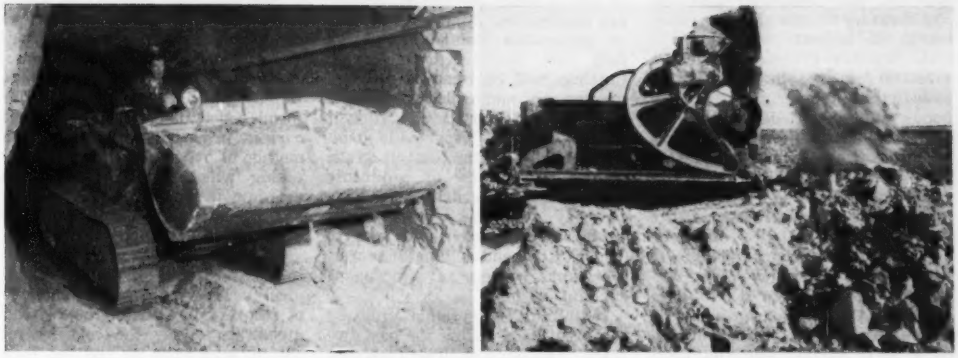
Demand for vanadium has been strong enough during the past year to absorb most of the by-product vanadium produced on the Plateau. The annual report of Climax Molybdenum Co. for 1951 stated that vanadium products of the Climax Uranium Co. mill at Grand Junction would be refined at the Langeloth, Pa., plant for sale.

The foregoing examples were limited to Plateau ores—the major domestic source of uranium. AEC is actively seeking uranium from other sources as well, and is empowered to negotiate special contracts to encourage production from such sources. These include primary ores such as those now being produced in Montana and Utah, copper-uranium ores, Florida and Western USA phosphate deposits, and residues of South African gold production. Some investigation is also under way of uranium-bearing shales.

Uranium Is Where You Find It

A number of new discoveries during the past two years have clearly shown that uranium occurrences are more widespread than formerly suspected. As a result the Plateau uranium province has expanded laterally, and also vertically in geologic members above and below the productive Salt Wash member of the Morrison.

For instance in sediments above the Morrison of Jurassic age, we find such producing deposits as the asphaltic carnotites of the Temple Mountain, Utah, area, and the copper-uranium occurrences of White Canyon, Utah, both of which are in the Shinarump formation of the Triassic. Deposits of uranium-bearing minerals have also been found in the Moenkopi and Chinle formations above the Morrison, in addition to the previously productive roscoelite deposits in the Entrada below the Salt Wash member of the Morrison. Likewise, in the recently discovered and now produc-



URANIUM MINING on the Colorado Plateau goes into high gear with modern equipment like this.

tive deposits in the Grants, N. M., area where early finds were in the Todilto limestone, later occurrences have been noted in the overlying Brushy Basin and Recapture sandstones.

Black Hills Discovery

A Black Hill's hobbyist who was making a study of Indian writings on sandstone cliffs is credited with having discovered carnotite lenses in the Lakota, lowest sandstone member of the Dakota, in an area north of Edgemont, S. C. He became suspicious of certain canary yellow stains which he noted during his ramblings and subsequently had the specimens identified as uranium minerals. This led to a considerable amount of claim staking, and it is now understood that Homestake Mining Co. and others are interested in this area. Optimistic speculations have been made that this discovery will open up a whole new geologic province favorable for uranium exploration, extending from the Black Hills into Wyoming.

Deposits of primary uranium minerals are also receiving much attention. Scanning briefly over reports during the past few years, we note pitchblende discoveries in the Pre-Cambrian Belt Series of the Coeur d'Alene district (Sunshine mine); uraninite occurrences in the Pre-Cambrian shield in the Upper Peninsula of Michigan, and pitchblende north of Lake Superior in Ontario; of uraninite and oxidized uranium minerals in the now productive Tertiary quartz-monzonite deposits near Marysvale, Utah; and in the Mineral Belt of the Colorado Front Range where deposits of pitchblende and uraninite are undergoing study. Among the Front Range deposits of interest are the following: The Copper King mine northwest of Ft. Collins; the Caribou property; the East Calhoun, Wood, Kirk, and German Belcher, Iron and Pewaubic operations near Central City; the Lawson-Dust, Joe Reynolds, Robineau Group, and Bellview - Rochester, near Idaho Springs; and primary showings at Golden Gate Canyon and Ralston Creek.

Other miscellaneous occurrences include black slate outcrops in the Uncompahgre Canyon south of Ouray, Colo., carnotite in the upper Morrison near Fairplay, Colo.; carnotite-lignite deposits north of Golden, Colo.; lignite-uranium deposits in Sandoval and Rio Arriba countries of New Mexico; and uranophane in old dumps of the Silver Cliff mine near Lusk, Wyo.

Water-soluble schroeckingerite is present in very small amounts in the Lost Creek deposit 40 mi. north of Wamsutter, Wyo. The mineral occurs in thin layers in an extensive old lake bed. Grade of ore is very low but tonnages are huge; hence the current interest in some kind of a low-cost, large-scale, hydro-metallurgical method to recover uranium from this source.

At Haputa Ranch, near Westcliffe, Colo. radioactive veins extending for thousands of feet have been of interest. Radioactivity is believed to be due to presence of thorium or rare-earth minerals rather than uranium.

To round out the list, we must include very low-grade Chattanooga shales (Devonian and Lower Mississippian) in Tennessee and Kentucky, and phosphate deposits in Florida, Wyoming, Montana, and Idaho as other possible sources or uranium.

Many of the deposits listed above have not yet proved to be commercial. However, in many cases the occurrence of uranium has been sufficiently interesting to warrant further study and exploration. Above all, the foregoing list shows how widespread uranium occurrences are. In fact, every geologic province should be considered suspect until definitely proved to be non-uranium bearing. Again we say, uranium is where you find it.

From a geologic standpoint, we suspect that you will hear more about the possibility of hydrothermal origin of secondary uranium deposits in the future. Also some very interesting work is in progress on the age of uranium minerals based on radioactive decay rates. Should such investigations indicate that the age of mineralization is about Tertiary for instance, some equally interesting theories on the origin of orebodies in the Jurassic sediments should be forthcoming.

Uranium Mining Pays

It is the opinion of this reviewer that more mining companies should show an aggressive interest in uranium mining and that such participation will prove profitable. AEC's price schedules are realistic, based upon a common-sense appraisal of the mining problems at hand, do not squander public funds, but allow a fair margin of profit for efficient operators who enter the field.

As prime evidence we cite the number of recent (past two years) newcomers into the field. These include Anaconda Copper Mining Co., Climax Uranium Co., Simplot enterprises, Vitro Chemical Co., American Metal Co., Santa Fe Railroad, and numerous smaller companies. In addition, Homestake Mining Co., St. Joseph Lead Co., Newmont Min-

ing Co., and American Smelting and Refining Co. are showing interest in the industry.

As another evidence of AEC's practical pricing policy, it might be added that the original $10,000 bonus offered for delivery of 20 short tons of uranium-bearing ores or mechanical concentrates assaying 20% or more U_3O_8 has not been collected to date. The bonus did not apply to carnotite-roscoelite ores of the Plateau. Now, however, a new production bonus applying to Plateau ores as well has been offered (effective Mar. 1, 1951 to Dec. 28, 1954) under which the Commission will pay a graduated bonus up to $35,000 depending upon quantity and grade of ore for initial production and delivery of acceptable uranium ores from new and certain existing mining properties. At the same time the minimum guaranteed price was increased from 50¢-$2 to $1.50-$3.50 per lb. U_3O_8, depending upon grade. To date, some 70 producers have been certified for receipt of this production bonus.

With an assured market until at least 1958, uranium miners are much better off than base metal miners. (Remember the 9 to 9.5¢ lead and zinc in 1949.) Furthermore all smart mining companies are recognizing the stabilizing value of diversification. That is why they are going into oil, non-metallics, precious metals, and new metals like titanium and rare earth metals. The obvious inference is—Why not consider uranium mining also? Even some of our major mining companies have painfully learned that liquid assets can be cut in half in less than a decade due to inflation. So again we suggest, why not put the investments into the ground?—specifically in uranium deposits, or in uranium metallurgical plants?

It should be added at this point, that mining on the Colorado Plateau is no cinch. Water for mining or exploratory operations is generally scarce—so scarce in fact that AEC makes a water resource survey in new areas a necessary adjunct to exploration work. Secondly, ore deposits are rarely continuous. They pinch out and roll, only to reappear 20 ft. above you or 20 ft. below you or off to the right or left of your development heading. This means that development and exploration costs are necessarily high.

Despite these difficulties, mining companies on the Plateau are doing a commendable job, with the help of AEC's many services to encourage production. New developments in exploration include the wagon drill with tungsten carbide bits. Cuttings will be removed by compressed air and collected in dust collectors. Radiometric logging of drill holes now in progress is yielding reliable information on grade of ore and nature of sediments penetrated by the drill hole. One company will use rotary drills equipped with roller-cone bits to explore. Diamond drilling of course, still ranks highest as a means of exploration.

In mining, exceptional progress has been made during the past two years. Old hand methods involving wheelbarrow haulage are replaced by diesel-powered rocker-type shovels or front-end tractors loaders in some operations. (See *E&MJ*, Jan., 1952.) Open-pit mining is being used on some seams as thin as 1½ to 2 ft. under 15 ft. of overburden. Since the orebodies are often thin and discontinuous, the operators have discarded the former gophering techniques and adopted low-cost methods of moving waste. Where orebodies have been indicated over fairly large areas, the advance is by systematic open-stope and pillar mining to the limits of the ore followed by pillar robbing in retreat.

Mills and Ore-Buying Stations

Transportation is another serious problem which is being met in two ways: (1) by strategic location of mills and ore buying stations, and (2) by highway improvement. Currently the following mills are operating in the Plateau area:

- Uravan, Colo., U.S. Vanadium Co.
- Rifle, Colo., U.S. Vanadium Co.
- Grand Junction, Colo., Climax Uranium Co.
- Durange, Colo., Vanadium Corp. of America
- Naturita, Colo., Vanadium Corp. of America
- Hite, Utah, Vanadium Corp. of America
- Salt Lake City, Utah, Vitro Chemical Co.
- Monticello, Utah, operated by the Galigher Co.

In addition ore buying stations are operated for AEC by American Smelting & Refining Co. at Monticello, Utah; Marysvale, Utah; and Shiprock, N. M.

To assist in the transportation problem, the Federal Government will provide the major part of some $4-million to improve or construct over 800 mi. of highway over which Plateau ores are now hauled.

The economic recovery of uranium depends not only on efficient ore production, but also upon advanced metallurgical techniques. According to F. W. McQuiston, Jr., Deputy Manager of the Raw Materials Operations, it is the goal of current investigations to develop a method of hydro-metallurgical processing which is as amenable to uranium ores as cyanide leaching and zinc precipitation are to gold ores.

And here it should be stressed that the accent is on hydrometallurgical techniques. Recent methods of recovery in mills in the Plateau areas use either the cold hydrochloric acid leach or the hot soda ash leash to extract vanadium and uranium from ores. These processes have been described in part in recent literature (see *EM&J*, March, 1951).

In Feb. 1951, Jesse Johnson, Manager of AEC Raw Materials Operations, issued a statement pointing out that in the production of phosphoric acid, sulphuric acid is used. Since uranium is soluble in sulphuric acid, and phosphate rocks contain low concentrations of uranium, he indicated that the Commission was interested in recovering the uranium from process liquors by new hydrometallurgical techniques now available. Several phosphate producing companies are cooperating in this project. Hydrometallurgical techniques will also be used to extract minute concentrations of uranium contained in South African gold tailings.

Now putting a few facts together, we come up with these interesting conclusions: (1) The AEC wants uranium, and wants private enterprise to produce it. (2) The occurrence of uranium is more widespread than commonly realized. (3) Uranium recovery is amenable to hydrometallurgical methods. (4) Tremendous advances in hydrometallurgical techniques have been made in the past decade.

Doesn't this suggest that every mining company which takes ores or concentrates into solutions should assay all solutions for traces of uranium and secondly to consult AEC to determine whether arrangements can be made to recover this uranium economically. Furthermore, it might be suggested that all custom mills install geiger counters over the belts feeding the fine ore bins.

E&MJ expresses its thanks to the operators on the Plateau who have pointed out many practical aspects of the uranium mining problem.

Minor Metals

Rising consumption and domestic production feature group including antimony, bismuth, cadmium, arsenic, beryllium, mercury, platinum, titanium

CHARLES WHITE MERRILL, Assistant Chief, Minerals Division, Bureau of Mines

COMPARISON OF 1951 with 1950 reveals an almost general rise in domestic production for the minor metals. Consumption, where estimated, shows uptrends. Prices increased in 1951 compared with 1950, except where government controls restrained them. Trends in imports were mixed because of uneven application of price controls among the commodities and between domestic and foreign markets.

Antimony

ABBOTT RENICK, Commodity Specialist, Bureau of Mines

PRIMARY ANTIMONY available for consumption in 1951 was about 22,000 short tons, compared with 19,721 tons in 1950. From actual primary consumption data for the first 10 months, it is estimated that industrial consumption of primary antimony increased about 15% over the 15,494 tons consumed in 1950.

Domestic mine production of antimony was 3,350 tons in 1951 compared with 2,297 tons in 1950. Bradley Mining Co.'s Yellow Pine mine at Stibnite, Idaho, was the principal producer. The current output at Stibnite is entirely in the form of antimony oxide.

Smelter production in the United States is estimated at about 11,500 tons against 9,471 tons in 1950. In addition, about 3,100 tons of antimony in domestic and foreign silver and lead ores was recovered, compared with 2,850 tons in 1950. Recovery of secondary antimony will approximate 22,400 tons, an increase from 1950.

Imports of contained antimony in ore are estimated at 12,000 tons compared with 8,966 tons in 1950. Imports of metal and antimony contained in oxide are about 3,600 tons, compared with 5,600 tons in 1950.

Effective Feb. 16, the National Production Authority issued Order M-39 restricting the size of a person's inventory of antimony and materials containing antimony to not more than the smallest quantity of such material which he reasonably requires to meet deliveries or maintain scheduled rate of operations during the next 60 days.

The market price for antimony, 99½% grade, in bulk, carlots, Laredo, Tex., Jan. 1, 1951, was 32c. per pound. For metal packed in cases, the price was 35.28c. less than carlots, New York, quotations nominal. Foreign antimony was priced nominally at 40c. per pound, duty paid, New York. National Lead Co. advanced its price to 42c. Jan. 22. Bradley Mining Co. quoted 50c. per pound, carlots, f.o.b. Cascade, Ida., February delivery. Foreign metal rose to 50c. per pound, New York, duty paid. From Jan. 25 to Nov. 20, 1951, prices remained unchanged.

Effective Nov. 21, the Office of Price Stabilization issued Ceiling Price Reg. 96, covering sales of antimony metal, antimony oxide, and sodium antimonate, including any by an importer or exporter. In general, the regulation set basic dollars-and-cents' ceiling prices for carlots, with adjustments to reflect certain transportation charges and with specified differentials for less than carlots and for special packing.

Ceiling prices for carlots of antimony were set at 49½c., 50c. and 50½c. f.o.b. shipping point, depending on grade. Where the shipping point is other than domestic producer's plant, the seller may add the lowest established railroad charge for transportation of a carlot from the producer's plant to the shipping point. As regards imported antimony metal, where shipment point is other than the port of entry, the seller may add the lowest established railroad charge for transportation of a carlot from the port of entry to the point of shipment.

A delivered ceiling price for carlots of antimony oxide in bags was set at 48c. a pound; for sodium antimonate the price was set at 42c. Effective Dec. 14, 1951, the OPS issued General Overriding Reg. 9, Amendment 10. This exempted from price control all sales of domestic antimony ores and concentrates.

In view of the strategic importance of antimony, and in an effort to develop and expand its production, the Interior Department has approved seven antimony exploration projects, three in Idaho, and others in Nevada, Oregon, Washington, and Arkansas.

Arsenic

ABBOTT RENICK, Commodity Specialist, Bureau of Mines

DOMESTIC ARSENIC PRODUCTION is directly related to the volume of copper and lead ores smelted. On the basis of nine months' production it is estimated that the total domestic output of crude and refined arsenic exceeded the 11,903 short tons reported in 1950.

Imports, mostly arsenic trioxide, for nine months exceeded 13,000 short tons, compared to 14,773 in all of 1950. Of this, 75% of the trioxide came from Mexico. Imports of metallic arsenic for the first nine months totaled 51 tons.

Apparent consumption of white arsenic was expected to be higher in 1951. The quoted price has been 6½c. per lb. in barrels, carlots, since Dec. 5, 1950.

Beryllium

STANLEY NEEDLEMAN, Commodity Specialist, Bureau of Mines

BERYLLIUM SUPPLY became critical in 1951 owing to sharply increased military needs and expanding civil-

ian requirements. A severe shortage of beryl ore lasting several months was caused early in 1951 through legislation in Brazil hampering export. Shortly after midyear, export licenses were issued by the Brazilian Government, releasing a substantial tonnage of beryl for the United States.

Domestic mine production is estimated to approximate the record figure of 514 short tons in 1950. South Dakota was the principal source, but significant quantities came from New Mexico, Colorado, and New England. Despite recent high domestic output, foreign ores (principally from Brazil, South Africa and Southern Rhodesia) comprised about 90% of the total domestic supply in the last decade.

Imports of beryl ore for domestic consumption in 11 months of 1951 indicated that 4,500 tons would be received by the year end. Two-thirds of this came from Brazil and South Africa, each sending half. Important quantities also came from Southern Rhodesia and India. Mozambique, Portugal, Uganda, and French Morocco were represented on a smaller scale. The ECA was active in rendering technical assistance aimed at developing beryl supplies in Southern Rhodesia, South Africa, and Mozambique. Negotiations for two beryllium-oxide processing plants in Brazil have been conducted by American and Brazilian representatives, acting for their firms and with the cooperation of the governments. Proberil, a Brazilian company financed with Brazilian and American capital, plans to erect a processing plant near Sao Paulo.

Beryllium Corp., Reading, Pa., and Brush Beryllium Co., Cleveland, Ohio, the major factors in the domestic business, were thinking of building new facilities for producing or treating beryllium-copper. With respect to the Brush company, this would serve to replace the facilities burned down in 1948 and to establish another source of beryllium-copper, now produced only by Beryllium Corp..

The problem of meeting growing military and civilian demands, principally for beryllium-copper, was being attacked by developing an increased ore supply, the creation of new alloys containing smaller percentages of beryllium, and substituting beryllium-free materials in certain less critical uses.

Government research programs to increase beryl supply are being sponsored by the DMPA with industry cooperation. The test work includes recovery of beryllium-bearing material (beryl and helvite) from domestic low-grade ore through beneficiation.

Nominal prices quoted in *E&MJ Metal and Mineral Markets* during 1951 for beryllium ore (beryl concentrates) per short-ton unit BeO, 10-12% BeO minimum, were: Domestic, f.o.b. mine, Jan 11, $26.28; March 1, $28-30; July 5, $32-34; Aug. 23, $33-37; unchanged thereafter. Imported, c.i.f. U.S. ports, Feb. 15, $28; July 5, $32; Aug. 16, $33-$36.50; unchanged thereafter. Since Nov. 15, 1950, beryllium-copper master alloy (4% Be, average content) has been quoted at $30-$32 per lb. contained Be (plus the price of copper at market), thereby keeping the quotation at the average of $1.56 per lb. of alloy. The previous pricing method, based upon beryllium content, has been discontinued, owing to a change in pricing policy by industry for convenience.

Bismuth

ABBOTT RENICK, Commodity Specialist, Bureau of Mines

VIRTUALLY ALL REFINED BISMUTH made in the United States is a by-product in refining domestic and imported lead and copper ores and imported lead bullion. The 1951 output remained on about the same level as in 1950.

Nine months' data indicate that imports will be less than in 1950. Of 392,644 lb. imported through September, 82% was from Peru. Nine months' imports in 1950 were 667,721 lb., and for the full year totaled 781,670 lb. Imports of bismuth in 1949 were 541,852 lb. Exports of bismuth metal and alloys, principally to the United Kingdom, in the first nine months were 113,002 lb., compared with 151,220 in 1950.

Estimates for nine months' domestic consumption indicate that metal products consumed 58% and the pharmaceutical industry 42%.

The New York market price of metallic bismuth has remained unchanged since Sept. 5, 1950, at $2.25 per lb. in ton lots.

Effective March 9, 1951, the NPA issued Order M-48, establishing controls on bismuth. To permit wider use of bismuth in the civilian economy, Order M-48 was amended Aug. 10, so that, effective Sept. 1, a consumer might accept up to 100% of his average monthly supply in the first half of 1950 or 100 lb. of metal, whichever is greater. Allowable deliveries to operators were increased from the former 30-day minimum to a new 45-day supply.

Cadmium

ROBERT L. MENTCH, Commodity Specialist, Bureau of Mines

PRODUCTION OF METALLIC CADMIUM in the United States in 1951 declined to an estimated 8,200,000 lb., approximately 11% below the 1950 output. Most of it came from primary sources—furnace flue dusts, zinc dust from distillation, and the precipitates from purifying zinc electrolyte. A small amount of secondary cadmium was recovered from old bearings and other alloy scrap. Production of cadmium compounds in 1951 was expected to be slightly less.

Comprehensive statistics on cadmium consumption are unavailable, but sales data indicate that the long-established use pattern remained virtually unchanged. The largest use continued to be for electroplating iron and steel, followed by that for bearing alloys and pigments.

Restrictions on use of cadmium were eased July 30, 1951, by NPA to permit increased use in a wide range of military and civilian products.

Conservation order M-19, restricting use of cadmium almost exclusively to war goods or essential civilian products, was amended because producers had been accumulating metal, anticipating a larger volume of orders.

Imports for consumption of metallic cadmium and cadmium in flue dust decreased about 28%. Metallic cadmium imports declined to about 90,000 lb., less than 15% of the 1950 rate.

Exports of metallic cadmium have been estimated at 340,000 lb. in 1951, virtually the same as in 1950. Shipments to ECA countries accounted for nearly all of the metal exported from the United States. France received about 51%, the United Kingdom 37%, and 10 other countries the remainder.

The New York price of $2.55 per lb. of commercial sticks of cadmium, quoted Dec. 1, 1950, con-

tinued in effect through Dec. 1, 1951. The price for special shapes was unchanged at $2.80 a lb. from Dec. 1, 1950, through Dec. 1, 1951.

Mercury

HELENA M. MEYER, Assistant Chief, Base Metals Branch, Bureau of Mines

MERCURY WAS CONSUMED at a higher rate in 1951 than in any other year except 1945. This unprecedented peacetime rate was the feature of the industry. Other features were the high, though not record, rate of imports, a reversal in the downtrend in domestic production that followed the 61-year peak of 1943, and the top annual price for all time.

The quarterly consumption peak reached in the first quarter of 1951 was caused by excessive orders placed when metal prices were skyrocketing late in 1950. The rate dropped sharply in the second and third quarters; total consumption in January-September was nearly 39,000 flasks compared with 34,300 flasks in the same period of 1950. The new large chlorine and caustic soda plant at Saltville, Va., that began producing in Nov., 1951, was a factor in the heavy consumption of mercury in the fourth quarter. Putting mercury into place in an electrolytic chlorine plant is not a dissipative use, but some metal is lost in operating the plant. Another large chlorine plant, which will use mercury, is being built at McIntosh, Ala., and may start up late in 1952. Much of the mercury required is already stored for use. Consumption for other purposes in 1951, based on 9 months' data, was not very different from 1950, a 60% gain in consumption for agricultural purposes being the chief exception. Smaller increases for industrial and control instruments and fulminate were partly offset by decreases in dental use and in making antifouling paint.

Imports continued heavy in 1951, nearly 33,000 flasks being entered in the first nine months. Italy furnished 44% of this, Spain 26, Yugoslavia 16, and Mexico 10, or a total of 96% for these countries.

Exports for nine months were 166 and re-exports 675 flasks.

Industrial stocks of 35,600 flasks at the beginning of 1951 were abnormally high, largely due to accumulation of metal for the Saltville plant. Inventories of 33,900 flasks on Sept. 30, included a substantial part of the metal required for the McIntosh plant. Stocks at the end of 1951, following withdrawals for Saltville, were more nearly normal but continued to include the McIntosh metal.

Price quotations more than trebled between the outbreak of war in Korea and late in January, 1951. Mercury was included in the general ceiling regulation that froze certain prices at the highest levels paid from Dec. 19, 1950 to Jan. 25, 1951. On Aug. 10 domestic mercury was exempted from price control. Foreign mercury was brought under the import regulation, effective Sept. 6, by an amendment to Ceiling Price Reg. 31. The average price for Jan.-Nov. was $210 a flask and probably was higher for the year as a whole. This may be compared with the previous peak of $196 in 1942.

World mercury production capacity is adequate for known world needs. This, combined with the fact that our strategic stockpile is more comfortably supplied with mercury than with most strategic commodities, placed mercury low on the list for aid under the Defense Production Act. Properties that could fulfill certain specifications, however, were granted exploration loans on a matching-funds basis, the Government meeting 75% and the operator taking care of 25% of costs.

Domestic production responded slowly to increased prices. The total for 1951 rose probably 30% above 1950 but was lower than every other year in the past 100.

Spain and Italy produced 50,000 and 53,000 flasks, respectively, in 1950, and some reports indicated that both would produce at least 50,000 in 1951. Planned plant improvements in both countries would raise production capacities to above previous peak production rates of 86,000 for Spain and 94,000 for Italy, both established in 1941. Total exports from Spain and Italy to the United Kingdom, the United States, and elsewhere dropped markedly in 1951, in part because of reduction in the speculative pressures that characterized late 1950. The United Kingdom imported 14,900 flasks in January to September, contrasted with 53,500 in the similar period in 1950. Re-exports were 5,200 and 10,000 flasks, respectively.

There was no evidence that Mercureo Europeo, the former Spanish-Italian mercury cartel, was to be revived.

Platinum-Group Metals

JAMES E. BELL, Commodity Specialist, Bureau of Mines

CONFORMING WITH THE PATTERN that has prevailed for years, most of the supply of platinum-group metals consumed in the United States in 1951 was imported, chiefly from Canada, the United Kingdom, South Africa, Colombia, and the U. S. S. R. The balance was recovered from domestic secondary sources, crude platinum produced in Alaska, and minor amounts in some states.

Features of the industry in 1951 were continued strong demand, high price, and adoption of controls on sales. Large requirements for the military program and defense-supporting industries held consumption at high levels. The quoted retail price of platinum remained at $93 per fine troy ounce throughout the year. It is understood that substantial amounts were sold at prices exceeding $93. In the face of serious shortages for military and essential civilian needs and as a result of meetings held in February and March between members of the Industry Advisory Committee for Platinum and officials of various government agencies, NPA Order M-54 was adopted, effective April 1, 1951. This forbids purchase of platinum for investment or speculative purposes and prohibits its delivery or acceptance for use in many consumer items, largely jewelry. Platinum in inventory of manufacturers of the prohibited items on April 1 is exempted from the provisions. In July the Waterval (Rustenburg) Platinum Mining Co., Ltd., South Africa, announced plans to double its output to about 180,000 oz. of platinum plus 100,000 oz. of other platinum-group metals.

In the first nine months, imported refined platinum plus domestically refined platinum totaled 175,000 oz. troy compared with 210,000 oz. for the corresponding period in 1950. Domestic and export sales of platinum together in this period of 1951 and 1950 were 162,000 and 223,000 oz. respectively. Domestic sales for industrial uses during the nine months of 1951 represented 85% of total domestic sales, compared with 55% in the same period

of 1950; sales for decorative uses, mostly jewelry, were 15% and 45%. Refiners' and dealers' stocks of platinum increased slightly during the first nine months. The government imported platinum for stockpiling, but the quantity is not reflected in the figures given.

Demand for palladium rose sharply in 1951 and continued an uptrend that had started in 1950. Refined imported palladium plus palladium domestically refined totaled 202,000 oz. in the first nine months of 1951, as against 108,000 oz. for the same period in 1950; domestic sales plus export sales were 198,000 and 120,000 oz., respectively. The largest user was the electrical industry. Refiners' and dealers' stocks of palladium increased considerably during the nine months. Palladium was quoted at retail at $24 per fine troy ounce throughout the year.

Activity in iridium, osmium, rhodium, and ruthenium together comprises only about 6% of the total activity of the group. Sales of osmium and rhodium were, respectively 1% and 44% greater during the first nine months of 1951, compared with the same period of 1950; and sales of iridium and ruthenium were, respectively, 45% and 16% less. Prices of the four metals per fine troy ounce throughout 1951 were: iridium $200, osmium $200-$215, rhodium $125, and ruthenium $93.

Titanium

FRANK J. CSERVENYAK, Assistant Chief, Light Metals Branch, Bureau of Mines

TITANIUM SPONGE was being produced at the end of 1951 at a rate of 2,800,000 lb. per year. Production in 1951 is estimated at 1,400,000 lb., coming from plants operated by E. I. du Pont de Nemours at Newport, Del.; Titanium Metals Corp. of America at Sayreville, N. J.; Niagara Falls, N. Y.; Henderson, Nev.; leased facilities at Boulder City, Nev., and Crane Co at Chicago.

Commercial production of metal in 1951 was based on Bureau of Mines' modifications of the Kroll process. Titanium tetrachloride, produced by chlorination of titanium ores, is reduced to metal with magnesium in an inert atmosphere. Magnesium chloride and excess magnesium are removed from the spongelike metal by vacuum distillation; the sponge is melted in induction or electric arc furnaces.

Du Pont started a commercial plant in May with a nominal daily capacity of 2 tons of sponge. The production rate originally estimated was reached in the latter part of 1951. Du Pont plans to reach an expected capacity of 2½ tons per day here in 1952. At the government's request, the General Services Administration was negotiating with du Pont for additional expansion in 1952.

Titanium Metals, jointly owned by National Lead and Allegheny Ludlum, following the signing of a letter of intent from GSA, announced plans in August for a 10-ton-per-day titanium plant at Henderson, Nev. Initial operation began in September, and routine production in October. Production of 2 tons per day was reached at the end of 1951, and capacity production of 10 tons per day was expected in the third quarter of 1952. This is the first fully integrated titanium plant with facilities for chlorinating ore and recovering magnesium and chlorine by electrolysis of magnesium chloride.

The Crane Co. built a titanium pilot plant and began producing sponge on a limited scale in the latter part of 1951.

New titanium organizations were formed during the year. National Research Corp., of Cambridge, Mass., and Monsanto Chemical Co. joined to develop an improved process for producing titanium. Work already in process by National Research was expanded, and new work started by Monsanto's research department at Dayton, Ohio. P. R. Mallory & Co. and Sharon Steel Co. formed the Mallory-Sharon Titanium Corp., which has reported no plans for a reduction plant. A new process for producing titanium metal was under investigation by Horizons Titanium Corp., a new firm formed by Horizons, Inc., of Princeton, N. J., with the backing of Ferro, Inc., of Cleveland, Ohio, and others. The process developed by Horizons, Inc., under sponsorship of the Office of Naval Research, advanced to a pilot-plant stage by the year end.

The first full season of ilmenite mining was completed at Allard Lake, Quebec. Quebec Iron & Titanium Corp., formed jointly by Kennecott Copper and New Jersey Zinc Co., shipped 340,000 gross tons of ore to the smelter at Sorel. With one furnace running, the smelter produced about 135 tons of titanium dioxide slag and 100 tons of pig iron per day at the end of 1951.

Production and shipments of titanium pigments increased 7% and 4% respectively, over 1950, exceeding the record made in 1950.

Domestic output of ilmenite in 1951 was 488,600 short tons containing 252,000 tons TiO_2. Increased production over 1950 was reported at the du Pont property, Starke, Fla.; Florida Ore Processing Co., at Melbourne, Fla.; Yadkin Mica & Ilmenite Co., Finley, N. C., and American Cyanamid Co., Piney River, Va. National Lead's Tahawus, N. Y., property continued the world's largest ilmenite producer. Ilmenite was also produced by Rutile Mining Co. of Florida at its Jacksonville property. Shipments totaled 480,000 tons containing 248,000 tons TiO_2 and were 6% higher than in 1950.

Imports of ilmenite for January to October, inclusive, were 186,400 short tons, 5% over the 177,000 tons received in the first 10 months of 1950. India continued to dominate the suppliers; minor quantities came from Canada and Australia.

Production of rutile in 1951 decreased slightly under 1950. It was produced by two companies in Florida, the Rutile Mining Co., at Jacksonville, and the Florida Ore Processing Co., at Melbourne.

Imports of rutile from Australia, sole supplier since 1947, were reported at 9,960 short tons in the first 10 months, 7,010 tons over receipts in the same period of 1950. Rutile was reported in short supply the latter part of 1951. Increased consumption was mainly in welding-rod coatings, alloys, and titanium metal.

Quotations per gross ton for ilmenite, containing 56 to 59% TiO_2, f.o.b., Atlantic seaboard, were $14-$16 at the start of 1951 and increased to $15-$17 in January and to $16-$18 in February, at which level they remained for the rest of the year. All quotations were nominal.

Nominal quotations for rutile guaranteed minimum 94% concentrate were 3½-4½¢ a lb. until the end of November, when they increased to 5¼-6¼¢ per lb. Rutile was under coverage of General Ceiling Price Regulation, Jan. 26, 1951, which established ceiling prices upon the basis of prices in effect during the base period, Dec. 19, 1950 to Jan. 25, 1951. The year closed with a ceiling price for rutile concentrate averaging about $100 per ton at East Coast ports.

Ferro-Alloy Metals

Higher prices for strategic commodities result from efforts of industry and government to increase supplies. Deficient transport limits manganese.

ROBERT H. RIDGWAY, Chief, Ferrous Metals and Alloys Branch, Bureau of Mines

A RECORD-HIGH RATE of steel production in 1951 continued to require larger tonnages of the ferroalloy metals. This resulted in all-out efforts by industry and government to increase raw material supplies, most of which are obtained from foreign sources. These demands increased the buying pressure further and resulted in higher prices. All of the ferroalloying materials except silicon and phosphorus are included in the strategic list of critical commodities and are being stockpiled as rapidly as possible. The production of high-temperature alloys for jet aircraft engines and gas turbines has placed added burdens on several of the critical metals.

While efforts to stimulate new production under the Defense Production Act had already resulted in expanded output in 1951, numerous contracts with the government were signed that eventually will increase production substantially through loans for exploration, development and purchase of ores on long-term contracts for stockpile. Domestic purchasing programs for procurement of chromium, manganese, and tungsten were established. The procurement responsibilities of the Defense Minerals Administration were transferred to the Defense Materials Procurement Agency, and the exploration and priorities functions were incorporated in the new Defense Minerals Exploration Administration late in the year.

Nickel, tungsten, cobalt, and molybdenum were among the materials placed on international allocation by the International Materials Conference. The IMC was established to permit equitable distribution of world supplies of critical items.

Chromite

NORWOOD B. MELCHER, Assistant Chief and JOHN HOZIK, Commodity Specialist, Ferrous Metals and Alloys Branch, Bureau of Mines

UNITED STATES IMPORTS of chromite in 1951 were estimated to be 12% higher than in 1950 and probably reached or exceeded 1.5-million short tons. The largest tonnage imported previously was 1,542,000 in 1948. Domestic consumption in 1951 (909,000 short tons for the first nine months) easily surpassed the former record of 980,000 tons in 1950.

Of the 1.25-million short tons of ore that arrived in the first 10 months, South Africa supplied 25%, Turkey 23, the Philippines 21, Southern Rhodesia 17, Cuba 6, and New Caledonia 5%; the remaining 3% came from British West Africa, India, and Yugoslavia. For the first time in 10 years the USSR shipped no chromite here; this compares with an initial shipment of 30,000 tons in 1942 which increased to a peak of 400,000 in 1948, then dropped to 72,000 in 1950.

South Africa (Transvaal) was the only supplier of chemical-grade chromite and was an important source of metallurgical ore. The latter came principally from Turkey and Southern Rhodesia; refractory chromite from the Philippines and Cuba and some from Southern Rhodesia.

Based on the rate of use in the first nine months, total consumption in 1951 should reach 1,200,000 tons, a new record. The proportion of metallurgical ore decreased from 50 in 1950 to 46% in 1951. The refractory grade increased from 36 to 38% and chemical ore from 14 to 16. The changes in the use-pattern reflect the increases in steel-furnace capacity and production; also the greater demand for chrome-plating, chrome metal, and leather-tanning chemicals.

Total consumers' stocks increased from 606,500 tons on Dec. 31, 1950, to an estimated 650,000 tons at the end of 1951. The stock position was less favorable because the estimated 7% increase in stocks was more than offset by the 18% increase in the rate of consumption over 1950.

Chromite prices moved upward during 1951, with the larger percentage increases generally occurring in the lower grades, resulting in continuance of the same general dollar differential between grades. In aggregate, price increases amounted to 23 to 25%. Representative increases may be indicated by the following prices, f.o.b. cars, eastern seaboard: Indian and Rhodesian, 48% Cr_2O_3, 3:1 ratio, \$36-\$38 (Jan. 1) to \$43-\$45 (Dec. 31); South African, 48%, no ratio, \$27 (Jan. 1) to \$34-\$35 (Dec. 31); Turkish, 48% 3:1 ratio, \$43-\$44 (Jan. 1) to \$53-\$54 (Dec. 31).

United States industries depend heavily on foreign sources of chromite. Domestic production in 1951 was 2,000 short tons compared with 400 in 1950. Although high-grade domestic reserves are inadequate to permit large expansion, research work may make available a considerable tonnage of usable material from low-grade deposits.

Cobalt

HUBERT W. DAVIS, Commodity Specialist, Bureau of Mines

RECORD CONSUMPTION AND IMPORTS, inadequate supplies, much greater use of scrap, increased prices, allocation, and initial production of concentrates in Idaho were some features of cobalt industry in 1951.

Consumption made an all-time record, chiefly because of greater use in high-temperature alloys, alloy hard-facing rods, and cemented carbides. Although the new supply of rondelles and granules in the first nine months was 24% greater than in the corresponding period of 1950, it was inadequate. Consequently, after Jan. 31, 1951, cobalt was put under allocation by the

NPA, which also prohibited its use in less essential products or where substitutes may be used. Consumption of cobalt scrap increased phenomenally.

During the first nine months, production of cobalt rondelles and granules in the United States was 1,184,000 lb., 1% under the corresponding period of 1950; but imports were 6,138,300 lb., a gain of 31%. Belgian Congo and Belgium supplied 6,015,000 lb. of the rondelles and granules, Canada 116,700 lb., and France 6,600. Sales of cobalt metal to industry were up 19%. Production and imports of oxide (gross weight) were 608,145 and 365,250 lb. respectively, a gain of 81% in output but a loss of 42% in imports. Belgium and Canada supplied 360,500 and 4,750 lb., respectively, of oxide. Oxide sales were down 26%.

Consumption by industrial consumers was 7,445,000 lb. in the first nine months compared with 5,448,500 in the corresponding period of 1950. Taking 48% of the 1951 total, cobalt-chromium-tungsten molybdenum alloys represented the largest single use for cobalt, and the quantity used was 171% greater than in 1950. Magnet alloys took 21%, but such use was 23% less. More cobalt was used in high-speed steel, alloy hard-facing rods, and cemented carbides; less for other cobalt-alloy steels, ground-coat frit, and pigments.

Bethlehem Steel Co. was the only producer of commercial cobalt as ore until June, 1951, when Calera Mining Co. began production of cobalt concentrate in Idaho. Calera's refinery, now building near Salt Lake City, is scheduled to be in operation early in April, provided there are no interruptions; it plans to produce metal at a rate of 3,300,000 lb. annually. Under an agreement between DMPA and National Lead Co., a plant will be built at Fredericktown, Mo. It is expected to be running in 18 months and will produce cobalt, nickel, and copper at an annual rate of 1,386,000, 1,852,000, and 1,418,000 lb. respectively. The metals will be processed from rejected residual iron concentrates from the production of lead at the company's Fredericktown reduction plant.

Cobalt production in Belgian Congo, the largest producing country, was at a record rate in 1951. Nkana's new electrolytic plant, Northern Rhodesia, for extracting cobalt from a flotation concentrate made by Rhokana, was put into operation late in 1951. Recovery of cobalt from copper-nickel matte by Falconbridge Nickel is expected to begin in early 1952. Shipments of cobalt metal refined at Deloro, Ont. from French Morocco cobalt ore contracted for by ECA were received in 1951.

Cobalt in white alloy (crude) imported from Belgian Congo during the first nine months was 1,712,495 lb., a gain of 30% over the corresponding period of 1950. Receipts of ore from Canada were 27,235 lb. a gain of 105%.

During the nine months, consumption of cobalt contained in white alloy and ore by refiners and processors was 2,140,657 lb., a gain of 15%, but use of cobalt intermediates by refiners and processors was 654,331 lb., down 17%.

Exports reported during the nine months were 7,161 lb. (gross weight) of metal, chiefly scrap and alloys.

Prices of metal and oxide were advanced. On Jan. 1, 1951, metal (97-99%) in 500-600-lb. kegs, was raised to $2.10 a lb. f.o.b. Niagara Falls or New York, and on Oct. 1 to $2.40 a lb. The former price of $1.80 a lb. had been in effect since April 1, 1949. On Jan. 1 the price of ceramic-grade oxide was raised to $1.60 a lb. (gross weight) east of the Mississippi and on Nov. 8, to $1.76. Sales of metal and ores were exempted from price control Aug. 10 and sales of oxide Oct. 12.

Allocation to the free-world countries for the fourth quarter 1951 was announced on Oct. 11 by the IMC. The United States was allocated 1,212 metric tons or 59% of the total.

Nickel

HUBERT W. DAVIS, Commodity Specialist, Bureau of Mines

ALLOCATION, PROHIBITION, and restriction in use in many items; acute shortage, higher price, and smaller consumption in the United States and increased output in Canada were some features of nickel in 1951.

The new supply of nickel for the United States in the first 10 months was about 4% less than in the same period of 1950 and was inadequate for industry and stockpile. Consequently, consumption and procurement were subject to NPA Order M-14, effective Jan. 1, 1951, and nickel was placed under complete allocation under Order M-80 effective Oct. 1.

Last July, International Nickel Co. of Canada announced that it had achieved its objective of increasing production of refined-nickel by 1-million lb. a month. This expansion was completed about five months ahead of the target date. Completion of a new 10,000-ton concentrator and a new shaft at Creighton mine was announced in September. Falconbridge Nickel continued its expansion and modernization program. It plans to change the process at its Kristiansand (Norway) refinery during the first half of 1952 and the new process and the expansion program that the company has been pushing is expected to boost capacity to 14,000-15,000 short tons by 1953. Falconbridge is sinking three new shafts in the Sudbury district. Sherritt Gordon Mines plans to start building its refinery near Edmonton, Alta., in 1952. It will treat concentrates from the company's mines at Lynn Lake, Manitoba. Annual production planned is 8,500 tons of nickel, 4,000 tons of copper, and 150 tons of cobalt. Partial production is scheduled to begin late in 1953. The company will refine its nickel concentrate by leaching it and precipitating nickel and cobalt as powders.

Rehabilitation of the nickel facilities at Nicaro, Cuba, proceeded in 1951, and the plant is scheduled to begin production in the first quarter of 1952. National Lead has acquired a substantial interest in the Nicaro plant, which will be operated by Nickel Processing Corp. under contract with GSA. It will have a capacity of 15,000 tons of nickel as oxide annually. Under an agreement between DMPA and National Lead, a cobalt-nickel-copper plant will be built at Fredericktown, Mo. This is to be in operation in 18 months. It will produce cobalt, nickel, and copper at an annual rate of 1,386,000, 1,852,000, and 1,418,000 lb. respectively, from residual iron concentrates from the production of lead at the company's Fredericktown reduction plant.

Output of nickel in Canada during the first 10 months was 114,619 short tons compared with 101,428 tons in the like period of 1950. Exports during these periods were 105,664 and 100,225 tons.

Nickel consumption in the United States was about 140-million lb. during the first 10 months and is estimated at 170-million lb. for the year, or 14% less than in 1950.

The decline was most pronounced for anodes, but substantially less nickel was also used in engineering steels, cast irons, and nonferrous metals. These losses were partly offset by a gain in usage in high temperatures and electrical resistance alloys. Consumption of nickel in stainless steels was about the same as in 1950.

Imports in the first 10 months of 1951 (figures for the full year 1950 are shown in parentheses) comprised 122,104,709 (138,364,185) lb. metal, 18,876,803 (22,270,886) lb. matte, and 19,255,154 (32,612,122) lb. oxide and oxide sinter. The nickel content of the unmanufactured nickel products imported is estimated at 149,476,000 lb. during the first 10 months. Canada was the chief source.

Exports consist largely of products made from imported raw materials. During the first 10 months (figures for full year 1950 in parentheses) they comprised 6,508,289 (5,675,771) lb. alloys and scrap, 341,151 (676,169) lb. metal, 354,362 (428,885) lb. nickel-chrome electric resistance wire, and 432,446 (496,598) lb. nickel-silver.

Effective June 1, 1951, the contract price to the United States buyers for electrolytic nickel in carlots f.o.b. Port Colborne, Ont., was advanced to 56½¢ a lb., including duty of 1¼¢. The former price was 50½¢. For nickel oxide sinter (no duty), the price was raised to 53¾¢ a lb. (nickel content) f.o.b. Copper Cliff, Ont.; the former price was 46¾¢.

Allocation of nickel metal, oxide, and salts to the free-world countries in the fourth quarter 1951 was announced Oct. 11 by the IMC. The United States was allocated 19,690 metric tons, or 63% of the total.

Tungsten

ROBERT W. GEEHAN, Commodity Specialist, Bureau of Mines

INCREASED DEMAND FOR TUNGSTEN early in 1951, coupled with loss of production from China and Korea, led to a steady increase in price. E&MJ quotations of London prices ranged from the equivalent of $50-52 per short ton unit at the first of the year to a peak of $85 on March 8. Domestic concentrate prices increased from $56.50 per short ton unit f.o.b. mine to $65; foreign concentrates, duty-paid, increased from $58-$60 per short-ton unit to $73.

This lead to an OPS order setting a ceiling of $65 per short-ton unit effective April 6. As the foreign price remained at or above $65 and the duty concentrates is $7.93 per unit, this tended to prevent the imports sorely needed to supply industry. On May 1 the OPS freed from price control tungsten concentrates of foreign origin sold to any agency of the United States, and a system providing for purchases of these concentrates for resale to industry was set up by GSA and DMA. Action by the IMC regarding international distribution of tungsten helped to reduce the strong competitive bidding for the metal; however, as of Dec. 13 the London price was still equivalent to $67 per short ton unit.

To stimulate domestic production, GSA announced a purchasing program to be carried out in accordance with policy determination made by DMA and certified by DPA. As announced May 10, this program provided for the purchase of standard-grade tungsten concentrates by the government at $63 per short ton unit for five years or until 1,468,750 units were purchased. On June 20 it was amended to provide for termination of the program when 3-million short ton units have been delivered or on July 1, 1956, whichever occurs first. There is a penalty schedule which outlines deductions from the base price of $63 for off-grade concentrates. In addition to this program, designed specifically for tungsten, the more general programs of DMA, DMEA and DMPA for stimulating mining of critical minerals provide for aid to tungsten producers.

The shortage of tungsten also led to issuance of Orders MO-4 and MO-6 by Defense Minerals Administration, regarding allocation of tungsten concentrates, the Orders M-30, M-80, and M-81 by NPA regarding allocation and use of tungsten products. OPS regulations affecting tungsten include GCPR-SR 42; CPR 19; CPR 33; and GOR 9.

The House voted to suspend import duties on tungsten concentrates and certain tungsten products. The measure has not been acted on by the Senate. Suspension will be for two years, unless the average price of concentrates drops below $63 a short ton unit if this bill is enacted.

The IMC was established early in the year to cope with international problems relating to scarce materials. The Tungsten-Molybdenum Committee has compiled data regarding the expected supply-demand situation in the area outside the Iron Curtain and has announced agreements covering distribution of tungsten and molybdenum for the third and fourth quarters of 1951. During the third quarter all producing and consuming nations represented, with the exception of Brazil, agreed that producing nations would not demand a higher price than $65 per short ton unit and that importing nations would pay at least $55, f.o.b. port of shipment. There was no similar agreement during the fourth quarter. However, it is reported that a four-year plan involving 65,000 metric tons of tungsten (metal content) with a price range of $35-$60, is under consideration. During the third and fourth quarters the United States was allotted 44.8 and 47.8%, respectively, of the estimated free-world production.

Production of domestic concentrates is expected to approximate 6,000 short tons (60% WO_3 basis) in 1951, a 50% increase from 1950. This increase resulted chiefly from expanded production at mines operating in 1950, but several mines that came into production in 1951 are now contributing significant amounts of tungsten.

General imports (receipts) of tungsten ores and concentrates into the United States were 5,283,000 lb. during the first 10 months of 1951 (8,285,000 lb. during the entire year 1950). These quantities represent ores and concentrates received in the United States, irrespective of final disposition; about 55% of total imports entered bonded warehouses. Portugal (1,017,000 lb.) Brazil (854,000 lb.), Bolivia (678,000 lb.), Australia (588,000 lb.), Siam (577,000 lb.) and Korea (426,000 lb.) supplied 78% of the total for the first 10 months.

Imports of ore and concentrates for consumption were 4,548,000 lb. during the first 10 months of 1951 (15,750,000 lb. during the entire year 1950). This represents ores and concentrates on which the duty has been paid and concentrates received duty-free for United States Government account. All the above import data refer to pounds of metal content.

Consumption of tungsten concentrates in the United States during the first nine months of 1951 was 9,435 short tons (60% WO_3 basis), compared with 3,940 tons in the corresponding period of 1950.

Manganese

NORWOOD B. MELCHER, Assistant Chief and E. J. GEALY, Commodity Specialist, Ferrous Metals and Alloys Branch, Bureau of Mines

REQUIREMENTS FOR MANGANESE ORE rose steadily during 1951, and all sources were pressed to the limit to obtain maximum imports. However, total receipts estimated at 1.8-million short tons, did not exceed those of the previous year, and a leveling off of foreign shipments to the United States was indicated. It appeared that further growth of receipts would result only from improving transport facilities in the major supplying countries and development of new sources. The trend led to the issuance of Mineral Order MO-2 by the DMA to control distribution of metallurgical and chemical ores.

Domestic production generally continued as in 1950 up until the late summer and fall, when strikes and mechanical difficulties interrupted the production of nodules by Anaconda in Montana. Domestic production of ore containing 35% or more maganese amounted to about 125,000 short tons. Of this, Montana produced over 90%. Manganiferous and ferruginous ore was shipped from six states, more than 90% coming from Minnesota.

Manufacture of ferromanganese and other alloys increased over 1950 and reached an estimated 840,000 tons. Ferromanganese imports increased, reaching 135,000 tons, mainly from Canada, Norway, and France. A large part of these imports was made from Gold Coast ore. Industry stocks of ferromanganese maintained the same level, the increase in supply being balanced by increase in consumption. Stocks of ferro, although holding their own tonnagewise, decreased relative to consumption.

In India, Gold Coast, and South Africa, manganese ore was forced to compete against alternate cargos, such as grain and coal, for available rail space. Expansion in rail capacity in these areas will come only through time-consuming changes in equipment and operating methods.

Ocean rates increased sharply during the first few months but tended to level off in the last half. This increase was reflected in the delivered price of all ore, whether it originated under long-term contracts or on higher-cost spot-purchase contracts.

Of the total imports of manganese ore in 1951, India supplied 31%; Gold Coast, 22; South Africa 21; Cuba 8; and Mexico 5. The remaining 13% came from Brazil, French Morocco, Turkey, Chile, Angola, and other sources.

Consumption of ore reached a new high of approximately 1.9-million tons. If the consumption of imported ferromanganese in terms of ore is added, the total consumption is estimated at 2.1-million short tons. Faced with this peak, ore supplies in consumers' stocks dropped to about 600,000 short tons at year end. This decrease in ore stocks was not only dangerous from a tonnage standpoint but from the position of grade as well. Although some ferro-makers dropped the grade produced, price penalties for lower grades caused the manufacturers to consume the better grades of ore to produce a standard product whenever possible. This led to a general deterioration in grade of ore left in stocks at year end.

Increasing demands in Europe and continuance of the transport problem have combined to limit the amount of manganese available for import by the United States. Probably the most notable economic change with regard to manganese ore during 1951 was in price, which moved upward gradually throughout the year. Certain large tonnage contracts were maintained at rates moderately higher, but odd-lot shipments (a substantial part of the supply) were offered at much higher prices in the late months. Still higher prices may be necessary to stimulate marginal production, although the real problem continues to be one of internal transport within the producing areas. Ferro manufacturers, faced with rising ore prices and controlled price ceilings on ferroalloys, appealed to the OPS for price relief.

Prices of ore, quoted at the beginning of 1951 at 88¢ to 92¢ per long ton unit, 48% Mn, c.i.f. U. S. ports, duty extra, rose to $1.20-$1.25 on the same basis but were meeting buyer resistance at the year end. Long-term contracts were nominally quoted at 90¢ to 95¢ c.i.f., duty extra, at the year end. Standard ferromanganese, 78-82% grade, continued at $185 per gross ton, but the price adjustment sought was under consideration by OPS at the close of the year. Import duty of ¼¢ per lb. of contained manganese was in effect throughout the year.

Molybdenum

ROBERT W. GEEHAN, Commodity Specialist, Bureau of Mines

PRODUCTION AND CONSUMPTION of molybdenum concentrates, it is estimated, were 30% higher in 1951 than 1950. Because of the great demand for the metal, concentrates have been placed under allocation by DMA, and orders issued by NPA covering allocation, use of metal and primary products. Production in 1952 and following years will be increased as a result of programs now in effect, and still further expansion is reported to be in the advanced planning stage. The IMC Tungsten-Molybdenum Committee announced agreements covering distribution of these metals for the third and fourth quarters of 1951. Use of molybdenum in tool steel has increased.

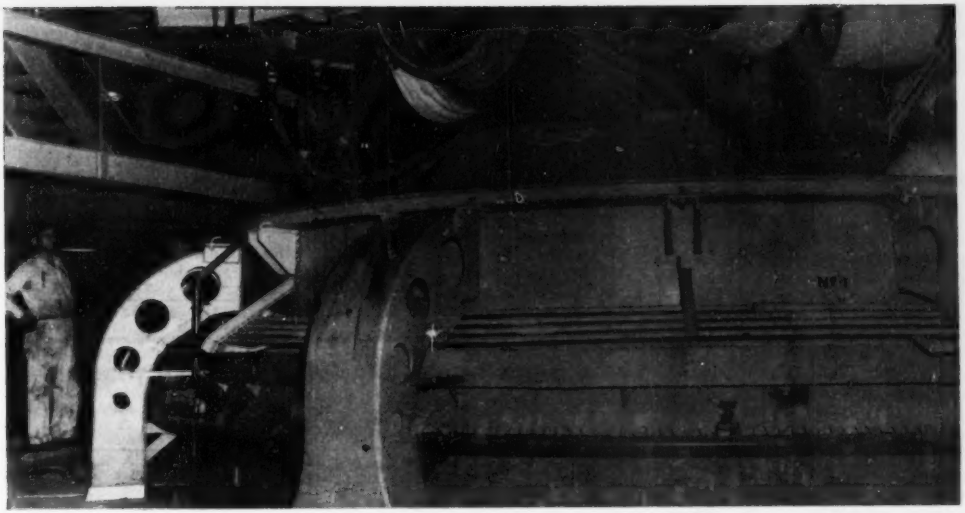
Exports of molybdenum contained in concentrates and molybdic oxide were 890,000, 201,000, and 1,407,000 lb. in the first, second, and third quarters of 1951. This compares with 1,794,000, 1,548,000 and 1,678,000 in the same period of 1950.

Domestic production of concentrates was 29,310,000 lb. (contained molybdenum) in nine months. Producing states were Arizona, California, Colorado, Nevada, New Mexico, and Utah. Colorado made the largest increase in production. Shipments of concentrates from mills in the first nine months comprised 25,332,000 lb. to domestic users and 2,021,000 lb. for export.

Consumption of concentrates was 25,095,000 lb. (contained Mo) in the first nine months, a 42% increase over the same period in 1950. Stocks of concentrates held by industry declined from 16,704,000 lb. (Mo) on Sept. 30, 1950 to 5,970,000 lb. on the same date in 1951.

Production and shipments of molybdenum products totaled 24,485,000 and 23,100,000 lb. (contained Mo) in the first nine months, gains of 42 and 12%. Stocks of products held by producers were 2,880,000 lb. (contained Mo) on Sept. 30, 1951, compared with 7,441,000 lb. on the same date, 1950.

In December 1950 the price of concentrates containing a minimum of 90% MoS_2 was raised to 60¢ a lb. of MoS_2 from the previous level of 54¢. It was still in effect in December, 1951.



ROTATING PHOSPHORUS FURNACE developed by Tennessee Valley Authority and rated at 7,500 kw., takes higher power concentration than TVA's stationary furnaces and produces phosphorus with less power.

Non-Metallics

New electric phosphate furnaces installed. Perlite expansion plants now total about 100.

Phosphate

H. F. DENGLER, Export Sales Manager, International Minerals & Chemical Corp., Chicago

ACTIVITY IN THE WESTERN PHOSPHATE FIELD[1] continues to center around the electric furnace. At Pocatello, Idaho, the Westvaco Division of Food Machinery & Chemical Corp. is expanding operations at their plant by installing a fourth furnace unit. At Silver Bow, Mont., the Victor Chemical Works have placed their first furnace in operation. Foundations for the second unit are in place and work is under way. Development continues at their two mining locations.

[1] Data on the western field has been furnished by Duncan King, general manager, San Francisco Chemical Co., Montpelier, Idaho.

Monsanto Chemical Co. decided early in 1951 to locate an electric furnace plant at Soda Springs, Idaho. By the year's end they had installed the railroad spur, constructed the general office building and poured the footings for the furnace plant. Stripping was started on the Ballard lease and a haulage road built. Monsanto's two principal phosphate properties were assigned to them by J. R. Simplot.

Anaconda Mining and Smelting Co.'s Fertilizer Division at Conda, Idaho, continued production, from the untreated footwall bed and beneficiated "hanging-wall" bed. The output was sent to their superphosphate plant at Anaconda.

The mines of Montana Phosphate Products, near Garrison, Mont., were run at near capacity during the year. The entire production has been shipped to the Consolidated Mining and Smelting Co. at Trail, B.C.

J. R. Simplot Fertilizer Co., at its mines at Gay, Idaho, on the Blackfoot Indian Reservation, mined approximately 500,000 tons of phosphatic shale for Westvaco's Pocatello plant; also a nominal tonnage of fertilizer-grade material for their own superphosphate plant at Don, Idaho.

San Francisco Chemical Co. recommissioned their mine at Montpelier, Idaho, and re-equipped their Waterloo pulverizing mill. The stripping and mining were done under contract by Peter Kiewit Sons, of Omaha. San Francisco's Wyoming operations produced at capacity during the year.

In the Tennessee field independent contractors continue to supply a large part of the phosphate mined and delivered to beneficiation plants.

Electric-furnace producers of elemental phosphorus have installed fluorine recovery units to avoid pollution. Monsanto will soon have nodulizing equipment to supplement sinter product used as furnace feed. A new entrant is the Shea Chemical Co., which proposes to build an electric furnace plant in 1952 for making phosphorus and di-calcium phosphate.

Ruhm Phosphate Co. is providing drying and grinding facilities to produce ground phosphate for direct application.

Virginia-Carolina Chemical Corp. is building a railroad ad-

jacent to its reserves in Giles County in order to ship whatever phosphate is mined to its Mt. Pleasant plant.

TVA Active in Phosphate

A New Rotating Phosphate Furnace.[2] Low power consumption, long life of lining, and capacity to smelt fine phosphate charge are advantages shown after a year's experimental operation of TVA's new rotating phosphorus furnace. Equipped with a hearth that turns on rollers, the 7,500-kw. furnace takes a higher power concentration than TVA's stationary furnaces and produces phosphorus with less power. The lining, essentially unattacked after the year's operation, lasts longer because of the rotating feature which prevents rapid wear under the electrodes. In recent operation a high proportion of the charge has been composed of uncalcined Florida pebble. This fine phosphate, hitherto held unsuitable for electric-furnace charge without agglomeration, is smelted satisfactorily. Combined, these improvements indicate considerable economic advantage of the rotating furnace over conventional types.

Major pilot-plant activities at Muscle Shoals have been concerned with development of fertilizer processes involving acidulation of rock phosphate with nitric acid. Sulphuric acid shortages and the consequent shortages of superphosphate have stimulated widespread interest in fertilizer processes using nitric acid. Based partly on European processes, several modifications and new procedures for use in the United States have been carried through the pilot-plant stage.

Natural gas is used as fuel in TVA's fused tricalcium phosphate plant at Godwin, Tenn. Gas is cheaper than oil, which was used previously for defluorinating rock phosphate. The fused tricalcium phosphate process requires no acid and little electric power and shows promise as an economical method for producing either fertilizer or animal-feed phosphate.

Florida Developing a Rounded Industry

Production High in Pebble Field. While the Western field can be looked upon as being still in the initial stages of development, and the Tennessee field as having passed its peak with the mining out of higher-grade acidulation rock and now being engaged mainly in furnishing direct-application material and electric-furnace burden, the Florida mining industry is of a vigorous maturity with continued high-level production. Aside from constant maintenance and expansion work in the mining proper, there is gradually developing in the field a related industry with the erection of phosphorus furnaces, phosphoric acid and concentrated superphosphate plants.

American Agricultural Chemical Co. reports that, while it has no plans for expanding its phosphate rock facilities, it is in the process of installing an electric phosphorus furnace of 6200-kw. capacity, the completion of which has been delayed until March or April, 1952, because of supply difficulties.

American Cyanamid Co. has completed a new machine shop equipped with a 5-ton mobile crane, a 600-ton wheel press and other modern machines and machine tools.

Early in 1951 a new 300,000-ton stacker belt for wet storage was completed and put into operation. Wet rock cars are dumped into a hopper with the aid of a mechanical car shaker. The hopper feeds direct to the stacker belt, which is capable of handling 600 long tons per hour. The stacker, set at 17 deg., has a radius of 268 ft. and permits storage to a height of 80 to 85 ft.

Coronet Phosphate Co., last August, put its new Tenoroc mine into operation. It is now proceeding to install wet storage, drying and shipping facilities.

Davison Chemical Corp. has improved its drying and loading facilities, and has put into service a 100-ton ALCO G.E. diesel-electric locomotive replacing two steam engines, and a new dragline with 195-ft. boom and 14-cu. yd. bucket will be added early in 1952 to the two now in operation.

International Minerals & Chemical Corp. during the year under review entered newly built offices at Bartow, Fla., and completed a new service center at the Noralyn mine. It comprises a warehouse for parts and supplies, fully equipped machine shop, electric shop and automotive garage. Main attention is centered on the large phos-

Table I.—Use Made of Phosphate Rock Produced in Florida, Tennessee and Western Field, 1940-1950

Uses	Florida % of Total 1940	Florida % of Total 1950	Tennessee % of Total 1940	Tennessee % of Total 1950	Western % of Total 1940	Western % of Total 1950	Total U.S.A. % of Total 1940	Total U.S.A. % of Total 1950
Superphosphate	67	64	55	22	62	26	64	56
Phosphoric acid, Phosphorus, etc.	6	6	37	60	0.5	38	13	15
Direct application	1	7	7	16	0.4	..	4	8
Various	1	4	1	2	0.2	9	1	4
Exports	25	19	..	..	37	27	20	17
	100	100	100	100	100	100	100	100

U.S. Phosphate Production 1950-1949

(In 1000 long tons)

	Florida	Tennessee	Western States	Total
1950	8,558	1,502	1,054	11,114
1949	6,695	1,403	779	8,877

World Shipments of Phosphate Rock 1950-1949

(In 1000 metric tons)

	United States	North Africa incl. Egypt	Pacific Ocean and Asia	Various Countries incl. Russia	Total
1950	10,253	7,043	2,073	2,572	21,941
1949	9,020	6,395	1,796	2,722	19,933

2 Dr. J. H. Walthall, Chief, Research & Engineering, Tennessee Valley Authority.

phate chemical plant under construction near the mines.

Swift and Company reports the developments at its Agricola mine as follows:

1. The Watson washer and flotation plant is being modernized with improved acid wash-box system, flotation feed tank, building repairs and electrical rehabilitation.

2. Facilities for storeroom and shop completed and in use.

3. New office facilities, control and research laboratories now under construction.

4. Sand tailings disposal belt is being extended to increase disposal capacity and eliminate use of bulldozer on top of pile. This will be accomplished through use of an extendable feeder conveyor and swivel stacker conveyor of the company's design.

5. A new 100-ton ALCO G.E. diesel locomotive has recently been put into service.

Virginia-Carolina Chemical Corp. has been erecting a second 650-B Bucyrus-Erie dragline. Another innovation is the method of tailings disposal which involves the pumping of tailings from flotation operations to reinforce existing earthwork dams around settling areas.

New Uses and Processes. As pointed out by Dr. Walthall, the sulphur shortage forced the fertilizer industry to look for methods other than the conventional superphosphate process. Foremost is the acidulation of phosphate rock with nitric acid, a process long used in European countries like Germany, France, Switzerland and Norway. Since the resultant fertilizer contains nitrogen, as well as P_2O_5, higher production costs are justified by a product of higher value. Melted or fused phosphate is another alternative to superphosphate.

The most important development lies in the field of phosphorus production by the electric furnace method. Not less than 30 units are now in operation with a combined theoretical capacity p.a. of 232,000 tons of phosphorus. This would take more than 1½-million tons of phosphate rock for furnace feed. Additional furnaces are under construction or in the planning stage. Electric furnaces provide the mining industry with an outlet for low-grade phosphate, the use of which is limited in other directions.

How the use of the phosphate sold in the U. S. has shifted over the last 10 years is shown by the comparison in Table I between 1940 and 1950.

Statistical Data and Outlook

Publication of U. S. phosphate statistics always lags about one year behind. We can recite here only facts and figures for 1950 and give an estimate of phosphate figures for 1951.

U. S. Production and Sales.[3] Total production in 1950 reached 11.1-million tons, exceeding 1949 by 2.2-million tons or 25%. Sales, or consumption, on the other hand did not keep step with the increased production, although with 10.3-million tons (1.2-million tons or 13% over 1949), they reached a new peak. In consequence, stocks on hand were increased by some 0.7-million tons, which was a desirable addition in view of depletions in 1949. The average P_2O_5 content per ton produced was 32.08% in 1950, as against 32.29% in 1949, and the average value per ton sold f.o.b. mines was $5.76 in 1950 as against $5.72 in 1949.

Expansion in sales occurred entirely in the Florida field: 8.1-million tons in 1950 as against 6.8-million tons in 1949. The Tennessee field held its own with about 1.4-million tons in both 1950 and 1949. The Western States showed a small regression by shipping not quite 0.8-million tons in 1950, which they had slightly exceeded in 1949.

The 1950 figures for Florida surpass the boldest estimates previously made. One hesitates to express an opinion as to what the 1951 production may have been. It is expected that because of changes in mining locations and other adverse factors, the output in 1951 will not have been as high as in 1950 when a record was established. Tennessee in 1951 will have reached 1.5-million tons and the Western States should show an increase to 0.9-million tons.

While the production and consumption of phosphate in the U. S. A. may stay put for one or two years, taking a longer view, it seems that the industry will doubtless make further progress. This assertion is made because (a) the fertilizer demand will increase. It will take a while to overcome the effects of the sulphur shortage by finding substitutes and new fertilizer manufacturing methods; (b) the installation of electric furnaces for production of elemental phosphorus will be accelerated; (c) the recovery of uranium from phosphate rock will be a driving force toward expansion, and (d) more phosphate will be used in foreign countries which will enhance export possibilities. In this connection, export shipments from the United States (mostly Florida) amounted to 1.8-million tons in 1950 as against 1.3-million tons in 1949. Imports were negligible, amounting to 87,000 tons in 1950 (65,000 tons in 1948). This is Curacao phosphate, which has a low fluorine content.

As proved in the course of the last 10 years, when total U. S. production rose from 4.1-million tons in 1940 to 11.1-million tons in 1950, the mining industry will be prepared and capable to satisfy the increasing demand.

Foreign Phosphate Statistics: Shipments from North Africa were as follows:

	In 1000 Metric Tons	
	1950	1949
Morocco	4,122	3,620
Algeria	651	619
Tunisia	1,734	1,937
Egypt	536	228
Total	7,043	6,404

Here, too, a considerable increase can be observed, which, based on actual shipping figures for the first six months will be continued and accelerated to probably 7.8-million tons in 1951.

The "Pacific Ocean" tonnage also increased in 1950: Ocean Nauru and Christmas Island, all operated by the British Phosphate Commissioners, mined 1,635,000 tons (1,322,000 tons in 1949). All was shipped to Australia and New Zealand. Makatea produced 273,000 tons, of which nearly all was sold to Japan. On the former Japanese islands of Angaur and Daitojima some 176,000 tons was mined and moved to Japan. Combined, the Pacific area shipped 2.1-million tons in 1950 as against 1.8-million tons in 1949. For a number of reasons, among them the sulphuric acid shortage, it is expected that the 1951 figure will be below that for 1950.

Generally speaking, in spite of serious handicaps, chief among them high ocean freight rates, the problem of foreign currencies, and the sulphuric acid shortage, world phosphate markets will further expand. In the U. S. A., in Europe, South Africa, and certain countries in Asia, all signs point toward increasing consumption, and new markets like South America and India will in due time require important quantities of phosphate rock.

[3] Most of the domestic statistics have been taken from Mineral Industry Surveys issued by U.S. Bureau of Mines.

Potash

G. T. HARLEY, Manager, International Minerals & Chemical Corp., Carlsbad, New Mexico

PRODUCTION OF POTASH in 1951 by the five major producers in the United States exceeded that of any previous year in the history of the industry. For the first nine months, the production of potash salts and the contained potash were 24% in excess of what it was for the similar period in 1950. It must be remembered that the strike, which began in 1949 in Carlsbad, was not settled until Jan. 28, 1950, and that it took several weeks to restore full production. Even without this loss of time in 1950, the production rate in 1951 is the highest on record. Figures for the total production in 1951 have not been made available to date.

Industrial Relations Good

The year 1951 was one of good industrial relations. During it there were no work stoppages, and pleasant relations existed between management and the three unions represented in the Carlsbad Basin, namely, IUMMSW, IBEW and IAM.

Normal management and union relationships continued to better throughout the entire year with an improving spirit of cooperation in solution of problems of mutual interest.

The cost of living escalator clauses introduced into the last contract amounted to an increase in wages of 12¢ per hour over the Jan. 1, 1951 figure.

Underground. While no major changes in underground operating methods were made during 1951, several minor changes and innovations were developed by the various companies. The diesel-driven crawler bulldozer has demonstrated its usefulness in cleaning roadways, stacking gob, and cleaning floors for the Joy loaders, and has become standard equipment. Experimental work with the hydraulically-operated boom-mounted drills operated from rubber-tired carriages has proved successful and additional units are on order. These "jumbos" are equipped with two drills each and are operated by two men who can drill as many holes as five men can drill with the present post-mounted machines. Drilling speed with these hydraulic drills has been found to be 8 ft. per minute in sylvinite ore.

Roof bolting continues to be highly satisfactory and the use of bolts is being extended. Extraction of pillars continues to be successful at International's mine. At present approximately 30% of the sylvinite ore tonnage is coming from the pillars.

Potash Company of America purchased two continuous mining machines which were put in operation in development headings and are proving successful in the mining of potash. Car-spotting hoists are in use at the loading heads in some areas and serve to eliminate use of a gathering locomotive and crew. United States Potash Co. designed and built in its company shops a diesel-powered trailer truck, which was put into service underground for use in development headings. This machine has 15-ton capacity and will travel at speeds up to 18 mph.

Blasting practices were improved with use of smaller holes and smaller powder. Former practice involves the use of blasting reels operated from a 220-v. ac circuit. These were kept close to the face to be blasted. Bulky and heavy, they had to be moved constantly. Current practice is to use portable battery-equipped capacitor-type blasting machines which can be attached to a shuttle car. In general, the unit consists of a condenser which is energized by two dry-cell batteries. The face is blasted by connecting the unit to the blasting circuit. This method is safer, cheaper and more efficient than the blasting-reel method.

Shaft Sinking by Freezing and Grouting

Shaft sinking at Carlsbad has held the interest of mining engineers in general. The International corporation completed its No. 3 shaft and No. 4 shaft is now nearing its objective. These shafts were sunk after the ground was pregrouted through drill holes from the surface, a method which proved very effective as no water was met in either shaft while passing through the water-bearing horizons. Development is now progressing rapidly to connect the main No. 1 hoisting shaft with shafts 3 and 4. Haulageways will be equipped for high-speed haulage with 75-lb. thermit welded track.

Potash Company of America was forced to resort to freezing at its south shaft site because of presence of quicksand in the water zone. Freezing and subsequent thawing were conducted satisfactorily and demonstrated the wisdom of using this method. The ground was frozen to 350 ft. and the shaft concrete-lined to 475 ft. The rest is unlined to an ultimate depth of 730 ft.

U. S. Potash Co. has begun work on a new 1,300-ft. circular shaft, 15 ft. in dia., which is to be used for additional ventilation and for serving north mine development. A long haulageway from present workings is progressing to connect with it.

Duval Sulphur and Potash Co. has completed one shaft and a second is nearing completion. Development work in the sylvinite bed is now in progress. Southwest Potash Co. is sinking two circular shafts. At both Duval and Southwest pre-grouting of the water zones was effected through a multiplicity of small-diameter holes drilled from the shaft bottom a short distance above the water zones.

U. S. Potash has installed a new headframe and hoist at its No. 2 shaft and a 150,000-cu. ft. fan at the shaft bottom, thus clearing the No. 2 shaft of surface air lock equipment formerly used for ventilation. The new equipped shaft will be used for auxiliary hoisting and ventilation.

At the Refineries

At U. S. Potash Co.'s granular plant, a new conveyor belt and slurry pump distribution system was installed to carry tailings to the tailings dump, and at the refinery work was begun on installing additional equipment to improve recoveries and increase production. More bagging and material-handling equipment for finished product was installed. A Rotoclone wet dust-collector was installed in the finished-product handling unit for better dust control. Ion exchange water softeners were charged with one of the new plastic-type synthetic softening agents. This resulted in a considerable increase in efficiency.

Potash Company of America increased flotation capacity by adding cells, and storage capacity for refined muriate was increased about 60,000 tons by erecting a new warehouse. The capacity of the diesel-electric power plant was increased about 20% by means of adding a new engine.

The potassium sulphate plant at

Dumas, Tex., has been in operation since early in the year. It utilizes the Hargraves process and as a by-product, produces hydrochloric acid.

International has increased its ore and K_2O production substantially over 1950 levels. Metallurgical efficiency has been improved through modification to centrifuges to obtain drier cakes, revamping furnaces and fireboxes to obtain decreased gas consumption and increased drier efficiency and by increased application of instruments for process control. Corrosion is being reduced by use of rubber pilot pipe and rubber-lined steel pipe and steel wherever possible.

Plans were made for an addition to the chemical plant in which to treat reject liquors from the potassium-sulphate plant for recovery of magesium values. Products proposed to be made are periclase and hydrochloric acid.

Duval Sulphur and Potash Co.'s new plant is nearing completion. During December, trial runs were made on ore from mine development, and a few cars of finished product were shipped.

Surface construction at Southwest Potash Co. is well under way.

General

A new general office is under construction by U. S. Potash Co. in the city of Carlsbad. This company has also equipped fixed industrial radio phone stations in Carlsbad, at the mine and at the refinery. A number of the company vehicles and tram-road equipment has been equipped with mobile stations. This equipment is being used for dispatching and emergency communications. Underground locomotives had carrier-current trolley phone equipment installed.

Heretofore general practice in the Carlsbad area has been to use 2,400-v. primary power distribution underground, transformed at portable stations to 240-v. ac for driving the machines. The current trend is to install 4,160-v. or 12,470-v. ac primary power distribution systems which will be transformed at portable underground stations to 480-v. ac power for delivery to the mining machines. Four conductor trailing cables are recommended, one lead being a ground wire.

If nothing unforeseen interferes, 1952 will see a greatly expanded potash industry with further improvements in operating and metallurgical efficiencies contributing to increased production.

Asbestos

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WITH THE EXCEPTION OF CRUDES in Quebec, asbestos production in 1951 again broke all records. Based on 10 months' statistics, an estimate indicates that Quebec alone will have turned out approximately 950,000 short tons of all grades of fiber; and Ontario an additional 25,000. Furthermore, whereas in 1950 shipments were valued at $65,855,000 for 875,000 tons (at an average of $75) the price increases of October, 1950 and January, 1951 —each about 10%—will probably bring the 1951 average return to nearly $90. This, in turn, should result in gross sales of $80-$85-million, comparing with a selling value of $21,469,000 in 1941; $25,241,000 in 1946; and $42,231,000 in 1948.

Including the Soviet Union, for which production figures are unavailable, world output is estimated at 1,350,000 to 1,400,000 tons. Quebec's output thus again accounts for 70% of the total. Such tonnages coupled with the changing American economy have begun to assuage the demand for some grades of fiber. However, crudes and spinning-fibers are still acutely in short supply, largely due to defense requirements. Likewise the demand for Group 4 fiber exceeds supply. However, there was a reasonable balance at the year's end in the case of Groups 5 and 6; and satisfactory inventories are being developed by manufacturers of products requiring the Group 7 series of "shorts."

The reasons for this market situation become evident from the following comparisons of the ratio of output of each group to the total for Quebec (1951 figures for 10 months only). In 1950 crudes represented only 0.09% of the asbestos produced; in 1951 they dipped still further to 0.08%. Spinning fibers amounted to only 3.5%, against 3.8% for the previous year. Shingle-stock in 1950 accounted for 19%, whereas last year the ratio will have dropped to possibly a trifle over 17%. On the other hand, the paper stocks (Group 5) represented almost the same proportion, 11.5% of total output against 12% for the smaller gross production of the year before. The real increase is in the proportionate output of 6th and 7th Group material, an increase which does not entirely depend upon the asbestos content of the mill-feed but can be controlled to a great extent by the operators themselves. For these two groups of short fibers, 6 and 7 respectively, the comparative figures probably will show 23% for last year against 20.5% for the year before and 45% versus 41.2%.

In 1950 the rock as mined in Quebec yielded an average of 7.13%, or 10.59% after sorting of waste to provide mill-feed. Of the 12-million tons mined, 29.3% was discarded. For 1951 the asbestos content will probably appear to be higher due to the additional amount of contained shorts which may have been extracted by the mills. The tonnage mined probably will approach 14-million, with possibly one-third of this sorted to waste.

Mill Capacity Little Changed

No new mill capacity of significance was added in 1951, the important additions and improvements having been concluded towards the end of 1950. Asbestos Corporation's Kings Mill operated at about 120 tons per hour; the Beaver at 125; the British-Canadian at 225; and Vimy Ridge at approximately 100. The "Corporation," therefore, milled approximately 570 tph in their plants or about 13,500 daily. Johns-Manville continued to handle approximately 10,000 tons daily at its main mill at Asbestos, Que. These two companies hence account for over two-thirds of the mill capacity in the Province.

The other producers have maintained production at about the previous year's rate, the only new mill to go into operation during the year being that of Continental Asbestos at Coleraine. This is a relatively small plant, with production as yet insignificant.

Increasingly larger tonnages of barren rock now must be mined. For example at the Beaver and British Canadian mines, rock going to waste had very nearly equalled the amount of ore over certain periods.

Highlights of the news concerning Asbestos Corporation are: The shaft at the King mine has been deepened to open two additional levels, the 1100 and 1300. The new orebody of the Vimy Ridge area has been further explored and plans are in progress to develop a new mine which will at the start be operated

as an open pit. A new and independent beneficiation plant will be built of 5,000 tons daily capacity. Present schedules call for production to start by 1954. The mine, to be known as the Normandie, will be able to operate eight or nine years by open pit, thereafter by block-caving.

A subsidiary, Asbestos Corporation (Explorations) Ltd., has been organized for investigating outside properties.

Install Aerofall Mill

An 18-ft. Aerofall mill has been installed at the Beaver. Driven by a 450-hp. motor, it is handling about 40 tph. Pilot-plant tests previously have indicated a substantial increase in value per ton of mill-feed, an expectancy that now seems possible of realization.

At Asbestos, Que., Canadian Johns-Manville is moving to increase the capacity of its block-caving system. Measures in hand include enlargement of the main shaft and sinking of a second, similar in design, to the second caving level at 1,400 ft. It is scheduled to be in use within five years. Additional equipment will then have been installed so that the change-over from open pit to underground mining should be completed.

Ground has been broken at Asbestos for a new mill, replacing the present one, though of about the same daily capacity. The development is to cost between $14 and $17-million.

Johnson's Co. is said to have decided to build a 5,000-ton mill on a recently developed section halfway between Thetford Mines and Black Lake. The work, it is thought, will start this year.

Bell Asbestos Mines Ltd. at the year's end had turned entirely to block-caving, thus terminating one of the oldest open-pit operations of the Thetford district.

Flintkote, Nicolet and Quebec Asbestos (Philip Carey) produced without interruption. United Asbestos Corp., owning the subaqueous deposits under Black Lake, completed mill-testing of a 10,715-ton sample taken from 1,783 ft. of lateral work on the 260 and 540-ft. levels. This was milled at the Asbestos Corporation's British-Canadian plant nearby. Officials advise that the sample represents an area of 950 by 375 ft. The results of the test were: Fiber produced: 3K-0.125%; 3R-0.418%; 3Z-0.90% —a total of 1.443% spinning-fiber; also, 1.59% of 4T and 0.43% of 5R; and finally 4.85% of no-test shorts (7R). The total, 8.30%, is evaluated by the company's consulting engineer into a resulting place-value of $9.15 per ton. The company claims reserves of 65-million tons and is discussing plans for a 5-ton mill.

A second potential producer, Dominion Asbestos Mines Ltd. (formerly International Asbestos) is also discussing a mill, of 100-tph rated capacity. Recent mill-testing of several hundred pounds of rock indicated a content of 4.2% test-fiber, equivalent to a 4T. This gives a value of $5.67 per ton to the ore. In addition, 6% of no-test material, 7R to 8S, is reported. This results in a total place-value of $7.40 per ton. Total estimated cost for open-cut equipment, mill, auxiliaries, working capital, etc. is slightly over $2-million. Ore reserve is estimated at 25-million tons.

The Jacob's property, adjacent to the site of the proposed new Johnson's mill, may be equipped for production this year at a rate of 2,000 tons of rock per day.

The foregoing shows that the new Normandie and Johnson's mines will provide an additional 10,000 tons of mill capacity daily for the district. If the United, Dominion and Jacobs carry out their plans, another 10,000 tons approximately would be added. What such production would do to the demand-supply ratio of the asbestos manufacturing industries would seem to raise an important question.

In Ontario, Canadian Johns-Manville's plant is in full production, turning out 25,000 tons of fiber annually.

Discovery in British Columbia

Apart from Quebec, perhaps the most exciting news in asbestos for 1951 has been the discovery and development of what is forecast to be an important chrysotile deposit in northern British Columbia in the McDame area south of the Yukon. This is controlled by Conwest Exploration Co. To own and operate the deposits, the Cassiar Asbestos Corp. has been formed. Unique features are: frost action has worked on a deposit of asbestos-bearing serpentine so that the main exposures now consist of a talus area 1,000 by 1,000 ft. on the west slope of McDame Mountain and 300 by 1,300 ft. on its east slope. These talus deposits consist of fragments of serpentine in a matrix of partially opened asbestos fiber. The depth of this detritus varies from 2 ft. on the fringes to an unknown depth over the main portion. The second remarkable feature is that beneficiation and spinning tests have indicated an 8% recovery of Group 3 fiber from a straight screening operation.

Although Cassiar (consisting of 37 claims) is remote, a 90-mi. gravel truck road has been completed to Mile 648 on the Alaska Highway. From here to the railway at Whitehorse, it is 270 mi. Disadvantages of the property's remote location should not prove serious due to the high average value of the fiber.

On a Ridge

The Cassiar showings are on a crest of a ridge running north from McDame Mountain at an elevation of 5,300 to 6,300 ft. The underlying rocks comprise a series of argillites, shales, a limestone and an overlying quartzite. These sedimentaries are intruded by a porphyritic granite and a basic rock, apparently altering the limestone to asbestos-bearing serpentine. The serpentine band appears to be about 400 ft. wide and outcrops showing an estimated asbestos content of from 5 to 10% (with fiber lengths from ⅛ in. to 1½ in.) are traced for over 1,200 ft. It is reported that ½-in. and ¾-in. fibers are common.

Equipment is being ordered for production on the basis of 6,000 tons of Group 3 fiber per year. This is equal to about one-sixth of the entire spinning-fiber production of Quebec. The plant is being designed for easy addition of crushing and fiberizing equipment when required. This, with added screening, would permit the production of Groups 4 and 5. At the start, power will be generated with diesel engines; but there is an excellent possibility of developing cheap hydro power within 6 mi. of the mill-site. Coal for drying the ore is available from the Yukon Coal Co. at Cermacks and a sawmill has been established in the area to cut and dress lumber for construction.

The method of mining the "hard-rock" orebody to be used has not yet been determined by the management, but the talus, which should provide sufficient mill feed for the first three years, will be collected on benches and lowered halfway down the mountain by skips and hoist. From that point it will be trucked to the mill (in the valley), about 5 mi. away.

Development will be actively continued this year so that the deposit can be better delineated. Sufficient ore from the talus will be removed

from the slopes during the summer to provide for year-round operation.

The effect of this new, relatively large production of Group 3 fibers (6,000 tons annually) on the present critical shortage of such material should be pronounced.

Other Activities

In Newfoundland, at Lewis Brook near Port-au-Port on the west coast, development has been resumed by Newfoundland and Asbestos Limited on a series of relatively small but high-grade chrysotile orebodies. These occur in peridotite intruded by numerous troctolite dikes to which apparently the asbestos owes its origin. A small mill is planned for 1952. Further exploration and development will proceed concurrently.

In the United States, the Ruberoid Co. mill in Vermont continues to operate on a basis of about 2,000 tons of rock per day. Arizona's production of the iron-free variety of chrysotile derived from serpentinized limestone remains small but important.

In Africa, Rhodesian production stays within the range of 6 to 7,000 tons of fiber a month. The fiber value is fairly constant at the equivalent of about $175 per ton. Crocidolite, or "blue" asbestos, is being produced from the Cape Colony at the rate of 2,500 tons per month and the annual output is reported to be worth nearly $4,500,000.

Cyprus is producing about 15,000 tons annually of shorter fibers from nine small mills handling a total of probably 450,000 tons of rock. Italy's production is nearing the 30,000-ton mark, most of the production coming from Cavo di San Vittore at Balangero and comprises the shorter and medium grades. Yugoslavia reports new finds in Macedonia, Bosnia and Serbia. New mines are to be opened and new processing plants built. The United Nations is supplying technical aid. Omnium Nord-Africain in French Morocco continues a small output of excellent and relatively long-fiber chrysotile, and additional exploration will in all probability lead to increased production.

All in all, 1951 marked an important year in the asbestos industry. In Canada, the world's largest producer, output has become so rationalized that the previous cloak of mystery with which each producer enveloped himself, for the most part has been dropped.

Sulphur

LANGBOURNE M. WILLIAMS, JR.,
President, Freeport Sulphur Co.

RECORD LEVELS OF PRODUCTION by the sulphur industry in the United States and the initiation of projects in this country and abroad which could bring an end to the world shortage of one of our most important raw materials were witnessed in 1951. In brief, we now can see the light at the end of the tunnel.

We thus enter the new year with a favorable long-term outlook for a substantial increase in the supply of sulphur. More than 50 projects are in various stages of development in this and 18 other countries. Within the next two years these projects, according to trade sources and published information, may add as much as 3-million long tons per year of sulphur in one form or another to the overall supply. In the coming months, however, the shortage will continue as the expanding rearmament program makes new and heavier demands on our resources.

On the basis of preliminary data, it is estimated that production of sulphur in all forms in 1951 amounted to approximately 6,200,000 long tons, 200,000 tons more than in 1950. Of the 1951 output, 5,500,000 tons was elemental sulphur or brimstone, 400,000 tons was sulphur contained in pyrites, and 300,000 tons was sulphur obtained in other forms from smelter gases and other sources. Of the brimstone, approximately 5,300,000 tons was produced from Gulf Coast salt dome deposits and the remainder was recovered from refinery and sour natural gases. The brimstone output was more than 2½ times the 1935-39 average.

The high production maintained by the brimstone industry in 1951 would have been sufficient to fill all of the nation's industrial and agricultural needs had there not been extremely heavy export demands. Approximately 1,300,000 long tons —or about 25% of all Gulf Coast brimstone mined last year—was allocated to friendly nations at the direction of the government. These quotas represented almost 95% of 1950 crude sulphur exports. The largest export allocations went to the United Kingdom and to Canada.

Export allocations were put into effect by the government on Jan. 1, 1951, in order to implement this country's policy of aiding its allies to resist aggression. There have been moves by these nations to increase their supplies of sulphur by a greater use of their traditional sources or by utilizing by-product sources. However, as in our own country, construction of new plants requires considerable time, and it is likely that no great change in the foreign supply picture will be evident in the near future.

To meet the 1951 export quotas, the major American brimstone producers had to limit domestic shipments. As a result, consumers here at home were not able to get all of the sulphur they wanted. In some cases, the domestic allocations represented proportionally larger cutbacks than those for export.

Limit Domestic Consumption

At the beginning of 1952 the government put into effect a program limiting the domestic consumption of sulphur to 90% of the adjusted use in 1950. The adjusted use figure includes the amount actually consumed in the calendar year 1950, plus requirements of new consuming plants built during or since 1950, plus allowances for hardship cases such as plant shutdowns due to strikes in the base period. Government officials believe that sulphur production in 1952—after deducting anticipated exports—will be slightly greater than the 1950 adjusted use figure, leaving a "kitty" that can be distributed as additional allotments for essential defense activities. Various uses were designated for this support. They include production and processing of metals; atomic energy requirements; production of military explosives, synthetic rubber, and rubber products; operation of petroleum refineries producing aviation gasoline; maintenance of health and public safety; and manufacture of pesticides.

It is imperative in the best interests of the nation that sulphur shipments be limited to the amount actually produced. Stocks of mined sulphur must not be further reduced. During 1951 inventories of sulphur in the hands of consumers were drastically cut. Stockpiles, which traditionally are maintained by the brimstone industry itself, had already been greatly reduced and are now at a minimum for national security. They have dwindled from a prewar

peak of two years' supply to one of about six months'. Government officials said that if actual production of sulphur in any quarter of 1952 indicated that total production would fall below their estimate, further reductions in sulphur use would be made in order to avoid reduction of stockpiles.

In retrospect, 1951 was a fruitful and eventful year. In the same manner in which American free enterprise has faced up to the other situations, many segments of industry began attacking the shortage problem. During the year four new brimstone mining projects and the expansion of an existing mine were undertaken. Other steps were taken to increase the supply of sulphur in one form or other from sources such as natural, refinery and smelter gases and from pyrites. Sulphur-using industries also undertook conservation measures aimed at recovering sulphur values formerly lost or dispersed as waste.

Oil Industry a Producer

A major user of sulphur, the petroleum industry, is reported by Petroleum Administrator Bruce K. Brown to be producing more sulphur than it consumes. This is being done by reclaiming sulphur in some form from spent acids and acid sludges, from hydrogen sulphide, and from acid recovery and sulphur extraction operations.

The natural gas industry likewise is aiding in the drive to step up sulphur production. Several plants are under construction to produce elemental sulphur from the hydrogen sulphide in sour natural gas. One of the country's biggest pulp and paper manufacturers, a large user of sulphur, plans to obtain about half its sulphur requirements from the waste ore of a Vermont copper mine. Increasing attention is being given to the production of sulphuric acid from smelter gases and to the utilization of sulphur values in pyrites from iron ores.

Our neighbor to the south, Mexico, plans to boost its sulphur production as the result of a number of projects involving both American and Mexican concerns. The U. S. Export-Import Bank has approved a $1,875,000 loan to the Mexican Gulf Sulphur Co., which has stated as its objective the production of 200,000 tons of brimstone a year from a property on the Isthmus of Tehuantepec. The Bank has under consideration a loan to Pan-American Sulphur Co. for the development of a mine of similar capacity. Petroleos Mexicanos, the nationalized Mexican oil industry, is now extracting sulphur from natural gas at Poza Rica field.

Industry in Canada is spending millions of dollars in an effort to increase that country's sulphur production. At least six projects aimed at recovering sulphur in some form from sour natural gas, pyrites and smelter gas are under way. Canada uses a substantial amount of sulphur, mainly for pulp and paper mills, with the U. S. supplying more than half of her total requirements.

Great Britain, increasingly dependent upon the United States for sulphur in recent years, now has undertaken a number of projects that are expected to lead to increased supplies of sulphur and sulphuric acid, and British interests are reported to be expanding production of pyrite mines in Spain. Italy has announced plans for enlarging the output of her Sicilian brimstone mines. Chile and several other South American countries, Norway and Japan all have new sulphur developments in progress.

In the United States, Texas Gulf Sulphur Co. is opening a new mine at Spindletop dome near Beaumont, Tex., which is expected to begin production this year. Texas Gulf also is expanding one of its existing mines, Moss Bluff, in the same general area. Jefferson Lake Sulphur Co. has already placed a new mine in operation at Starks dome in Louisiana. Freeport Sulphur Co. is developing two deposits in the same state, one at Bay Ste. Elaine dome scheduled for completion late this year, and the other at Garden Island Bay dome expected to be finished in 1953.

A Marsh Dome

The Bay Ste. Elaine project illustrates the unusual difficulties faced in developing the so-called marsh domes. Because of the small size of the deposit and the fact that two-thirds of the dome lies under water, Bay Ste. Elaine will be mined with an "amphibious" plant, the first of its kind in the brimstone industry. The entire plant, including facilities for providing 2-million gal. of hot water daily, will be assembled on barges, towed 75 mi. to the mine site, and sunk in place in the marshes.

The development of these new deposits in Louisiana and Texas follows many years of exploration by the brimstone industry as well as by others. In the course of these efforts, millions of dollars have been spent on prospects that in the end had to be abandoned. For a long span of years there were virtually no new sulphur discoveries. The perseverance of the prospectors and their willingness to continue to risk large sums of money in the search for more sulphur have been responsible for the accomplishments that we are now seeing.

Although the odds against finding new sulphur deposits are great, the search is constantly being waged. And the efforts to obtain sulphur in other forms, both in this country and abroad are continuing. The new year could well bring further strides toward making available increasing quantities of sulphur for every segment of American industry.

Fluorspar

HUBERT W. DAVIS, Commodity Specialist, Bureau of Mines

RECORD CONSUMPTION of fluorspar at basic open-hearth steel and hydrofluoric acid-plants, higher prices, reduction in rate of duty on acid-grade fluorspar, an increase in the rate for lower grade, and a shortage of acid grade were features of the fluorspar industry in 1951.

Consumption of fluorspar in the United States in 1951 will, it is estimated, reach the unprecedented total of nearly 500,000 short tons, a gain of 17% over the former record established in 1950. The steel industry, which also set a new record in 1951, continued to be the predominant user, consuming about 55% of the total. This usage, which established a new high, was about 275,000 tons or about 14% more than in 1950 and 13% greater than in the former record year, 1942.

Usage of fluorspar by the hydrofluoric acid industry, the second largest user, also established a new record at about 153,000 tons, or 23% more than in 1950 and 18% greater than in the former record year 1944. The hydrofluoric acid industry accounted for about 31% of the total fluorspar consumed in 1951. Had adequate supplies been available, more would have been

used. Fluorspar was consumed by the glass trade at a slightly higher rate in 1951 than in 1950, but less was used by the enamel industry.

Consumption of fluorspar in the United States, 1950-1951, by industries, in short tons

Industry	1950	1951 (estimated)
Steel	240,802	275,000
Hydrofluoric acid	124,440	153,000
Glass	33,440	35,600
Enamel	7,723	6,700
Other	19,716	26,700
	426,121	497,000

Domestic production and shipments in 1951 were much greater than in 1950 but again fell far short of meeting industry's requirements. The Illinois-Kentucky district continued to be the chief source of domestic fluorspar. Shipments of metallurgical and acid-grade fluorspar from other states also increased. However, shipments of metallurgical-grade fluorspar from other states declined substantially, chiefly because of lessened activity by producers in the Topaz district near Delta, Utah.

The flotation mill of Fluorspar Mines, Inc., near Forney, Idaho, made its initial production of acid-grade concentrates in the third quarter 1951. Under an agreement between DMPA and Ozark-Mahoning Co., a flotation plant to produce about 25,000 tons of acid-grade concentrates annually will be built near Northgate, Colo. Ore will come from the company mines also near Northgate. The flotation plant is expected to be in operation about mid-1952. The Reynolds Metals Co. has acquired the Aksarben mine and flotation mill serving it near Salida, Colo.; the mill began production in November. The Pennsylvania Salt Mfg. Co. has acquired two flotation mills near Marion, Ky. Fallon Fluorspar Mines, Inc. (H. W. Gould & Co.) has purchased the Baxter mine near Broken Hill, Nev., and plans to install a Heavy-Media plant and a flotation mill. Production at the flotation plant of Alcoa Mining Co. at Rosiclare, Ill., was increased substantially in 1951.

Imports of fluorspar into the United States were at a record rate in 1951; during the first 10 months they amounted to 136,591 short tons, which compares with 110,534 tons in the corresponding period 1950 and with 164,634 tons in the entire year. Mexico continued to be the chief source of the imports in 1951 but supplied less than in 1950. Less fluorspar was also received from Spain, Italy, and France. These losses, however, were offset by larger imports from Newfoundland and Germany.

As a consequence of abrogation of the reciprocal trade agreement between the United States and Mexico on December 31, 1950, the duty on fluorspar containing not more than 97% calcium flouride reverted to $7.50 a short ton and the duty on higher grade to $5 a short ton. However, effective June 7, 1951, the rate of duty on fluorspar containing more than 97% calcium fluoride was lowered to $1.87½ a short ton under the Torquay Agreement.

Requirements for fluorspar in the first nine months of 1951 were greater than the new supply made available; as a consequence, stocks held by consumers dropped from 164,685 short tons on January 1 to 154,962 tons on September 30, 1951 and were sufficient for less than four months' consumption at the third-quarter rate of usage. Stocks held by producers continued abnormally low.

Metallurgical-grade fluorspar with 70% or more effective calcium fluoride content was quoted at $43 a short ton f.o.b. Illinois-Kentucky mines throughout most of 1951. Imported metallurgical-grade fluorspar was quoted at $36 to $40 a short ton at Atlantic seaboard, duty paid. Acid-grade fluorspar was quoted at $50 a short ton f.o.b. Illinois mines until October 1, when it was advanced to $60.

Price Control

Throughout 1951 the price of domestic metallurgical-grade fluorspar was controlled by provisions of the General Ceiling Price Regulations, which froze prices at the highest charged between December 19, 1950, and January 25, 1951. The prices for acid-grade and imported metallurgical grade were likewise frozen until August 10 and September 6, respectively. However, on August 10 acid-grade fluorspar was exempted from price control, and on September 6 sellers of imported fluorspar were permitted to add increased landed costs.

Consumption of fluorspar in 1952 will be substantially greater than in 1951, chiefly because of the expanded outputs of steel and hydrofluoric acid. To meet the needs of industry and the government stockpile objective for acid-grade fluorspar, it will be necessary to provide additional flotation plants.

Perlite

S. W. JOHNSON, President, Texas Panacalite Co., Irving, Texas

COMMERCIAL PRODUCTION OF PERLITE began in a very small and sporadic way about 1940. Around 1946, interest in the new lightweight aggregate began to spread and substantial capital to be invested in ore deposits and experimental expanding plants. By 1949 the industry had progressed through the initial formative stage and a number of companies were in commercial production concentrated in the extreme west and southwestern United States. The building industry welcomed the aggregate with its labor savings, reduction of dead load, greater insulation and fire protection.

News of the new product spread rapidly and many individuals hastened to get into the perlite business, both in mining the ore and in expanding it. The result was chaos, there being no standardization of product and often little knowledge of the overall problem. Wise heads in the industry soon realized the need for organization, to help put the industry on a firm basis, to establish standards for products, obtain approved fire tests, institute needed research, disseminate knowledge, and obtain publicity. This led to the formation of the Perlite Institute in May, 1949. The Institute consisted originally of 12 member companies. Rapid strides were taken to achieve the objectives set forth and the industry began a sensational growth.

Records of the Institute show that sales of member companies in 1949 totaled 1,234,921 bags of 4-cu. ft. capacity, representing approximately 20,580 tons of crude perlite ore. Sales of member companies in 1950 doubled, amounting to 2,465,336 bags, equivalent to about 41,090 tons of ore. The rate of growth continued unchanged into 1951. Figures available indicate a probable total sales of close to 5-million bags last year, representing approximately 83,340 tons of ore. Institute membership has increased to 45 members.

A survey of the industry by the U.S. Bureau of Mines released in 1951 gives the following figures:

(Please turn to page 113)

Barite

R. ROWAND, Production Manager
Baroid Sales Division, National Lead Co., Los Angeles, Calif.

ACTIVITY IN THE BARITE INDUSTRY rose in 1951 due to increased demand from the chemical industry and oil-well drilling companies, the principal consumers. For the chemical industry, high purity and whiteness of ore are prime requisites. For drilling mud, the product must have a high specific gravity and desirable mud-making properties when finely ground.

No new major sources have been opened and the same deposits lead in production as in 1950. Arkansas heads the list in output, all of its barite being ground for well drilling. Missouri ranked second, supplying its barite to the well-drilling industry, the chemical industry, and for use as a heavy aggregate in concrete for weighting and coating oil and gas pipe lines. Nevada and Georgia are next in importance. Other states with known production are Arizona, Tennessee, California, Idaho, New Mexico, and South Carolina. Total domestic production for 1950 was 695,414 short tons. It is estimated that production for 1951 exceeds this figure.

The increased production of barite (barium sulphate) for the chemical industry was due to a greater demand for barium base pigments and barium chemicals in general. An increased amount of barium carbonate (occurs as witherite) was used in the production of barium titanate, a dielectric used by the electronics industry. During 1950, 74,126 short tons of barium chemicals was sold by producers.

Missouri is the largest source of domestic chemical-grade crude barite. Recovery is by open-pit mining of fragments in residual clay. Separation from the clay is accomplished by log washing, crushing, and jigging. Minus half-inch concentrates are shipped in bulk to chemical plants. Some operators reduce the iron, lead, and silica content of lower-grade ores by tabling, decrepitation, or magnetic separation. Tabling also is used to obtain higher recovery from sands and log washer and jig overflows.

Nevada ore of sufficient purity for chemical use without concentration is obtained by selective mining. A new deposit is being developed for this purpose. Georgia and Tennessee also produce a small amount of chemical-grade ore.

Other sources for this industry are chiefly Nova Scotia, Yugoslavia, and Italy.

Overall production of barite during 1951 for weighting drilling mud increased over the 1950 figure of 483,519 short tons. Most of this came from Arkansas. Here the ores are low-grade and require concentration by flotation. The barite particles are liberated by grinding to approximately 325 mesh. This fine grind is a deterrent in the use of the product in the chemical industry. Mining is by both open-cut and underground methods. Barite production from Arkansas during 1951 increased over the 1950 figure of 343,168 short tons.

Operations in Missouri turned out large tonnages of ground barite for the drilling industry during 1951. Contamination by small amounts of silica and iron is not critical and some of the lower-grade Missouri ores can be used for this market. Missouri production is derived largely from log washing and jigging plants, followed by dry grinding.

Demand for Nevada ore increased in 1951. These ores are of high quality and do not require concentration. Mining is done in open pits.

Sources of Georgia production were open-pit mines and tailing-pond reclamation by sink-float and flotation concentration.

Arizona barite is mined largely by underground methods, with concentration by flotation at a mill in Mesa. Production in 1950 was about 8,000 tons and probably increased in 1951.

Idaho barite is supplied by one company.

Only a small tonnage of barite was mined in California in 1951; however, a large portion of the western mine production is ground in California, both for chemical and well-drilling use.

Imports and Exports

Imports of barite probably exceeded the 1950 figure of 58,381 short tons. Foreign sources, in order of importance, are Nova Scotia, Yugoslavia, Italy, and Mexico. Import tariffs were decreased in 1951 for ground barite from $7.50 per long ton to $6.50 and on crude barite ore from $3.50 per long ton to $3.

Ground barite for the oil-well industry was exported principally to Canada, Mexico, Chile, Peru, and Venezuela.

Feldspar

BROOKE L. GUNSALLUS, Commodity Specialist, Bureau of Mines

PRODUCTION OF CRUDE FELDSPAR in 1951, based on trends in the first three quarters, is somewhat less than the 1950 output (407,925 long tons). Several large producers agree that the 10% increase in crude tonnage in 1950 over 1949 will not be maintained in 1951, although the cutback will not reach the 1949 level. North Carolina is expected to mine and grind about 45% of the total United States tonnage in 1951, which is comparable to 1950. A froth flotation unit was installed at Spruce Pine in 1951 by the Carolina Mineral Co., subsidiary of Consolidated Feldspar Corp., Trenton, N. J. This unit which has a capacity of 3,500 short tons of glass-grade 20-mesh, material per month, started running in August. Appalachian Minerals Co., Monticello, Ga., lost its plant by fire in November and may not resume operations until the middle of 1952.

Ability of the glass, pottery, and enameling industries to keep pace with present demand and reduce their accumulations of orders caused a general decrease in plant output in the second half-year. Postwar expansion had made itself felt in the 1950 production to such an extent that the uptrend could not be maintained in 1951. This, in addition to certain restrictions in the steel and construction industries imposed in emergency regulations, caused industrial consuming felds to slow down.

Statistics for nine months indicate that imports of feldspar will be negligible in 1951. The figures for imports of crude and ground nepheline syenite in the first three quarters suggest the possibility of a 10% rise in 1951.

It is reasonable to assume that sales of ground feldspar in 1951 will be less than the 446,523 short tons reported as sales by producers to the Bureau of Mines in 1950, but possibly more than the 386,707 short tons reported from the same source in 1949.

The glass, pottery, and enamel industries consumed 99% of all ground feldspar in 1950 and can be expected to follow the same use pattern in 1951.

Perlite Ore Produced and Sold in United States

Year	Sold Short Tons	Sold Value	Expanded by Producer Short Tons	Expanded by Producer Value	Total Short Tons	Total Value
1946	1,500	$ 8,300	3,100	$ 16,300	4,600	24,300
1947	550	3,000	9,900	55,000	10,450	58,000
1948	4,400	29,000	17,800	106,000	22,200	135,000
1949	27,300	193,000	43,800	317,000	71,100	510,000
1950	59,802	411,205	41,734	237,957	101,536	649,162

Expanded Perlite

Year	Sold or Used	Value
1946	2,600 short tons	$ 92,500
1947	7,700 short tons	271,000
1948	18,600 short tons	742,000
1949	58,100 short tons	2,385,000
1950	86,962 short tons	4,741,383

(*Continued from page 111*)

Perlite Ore Production

1946 ..... 4,750 short tons
1947 ..... 10,500 short tons
1948 ..... 22,300 short tons
1949 ..... 71,500 short tons
1950 .....110,694 short tons

Expanded Perlite Production

1946 ..... 4,100 short tons
1947 ..... 9,700 short tons
1948 ..... 21,200 short tons
1949 ..... 58,100 short tons
1950 ..... 88,892 short tons

Comparison of the Institute and Bureau of Mines figures indicate that expanded perlite production is about equally distributed between members and non-members of the Institute.

Data on the values of perlite produced and sold in the United States, prepared by U.S. Bureau of Mines, are given in an accompanying table.

Value of production in 1951 based on Institute figures available and assuming production as reported to the Institute to follow the past indicated ratio of roughly 50% of the total, overall quantities and values in 1951 are estimated as follows:

Perlite Ore Sold .....Value
160,000 short tons $1,100,000

Expanded Perlite Sold

10 million bags (4-cu. ft.), $10 million

Average ore value is estimated at $6.90 per ton f.o.b. mine. Average value of expanded perlite is estimated at $1 per bag (4-cu. ft.) f.o.b. plant.

These figures, although admittedly a rough estimate, nevertheless have enough factual base to indicate an increase of 100 times the value of expanded product sold within a period of six years, which is truly phenomenal.

One Hundred Expanding Plants

There is good reason to believe the industry will continue to grow at a rapid rate over the next few years. It is characterized by many relatively small independent expanders. There are no large companies with nationwide fully owned integrated plants. Two companies, however, license their trademark and processing plants to independents on a national basis. Total number of expanding plants by the end of 1951 is estimated at 100.

Production of crude perlite ore was largely concentrated in two plants, one owned by Combined Metals Reduction Co., Pioche, Nev., and the other owned by Great Lakes Carbon Co., near Socorro, New Mexico. Dantore, in Oregon, and Alexander Film. Co., in Colorado, also contributed substantially to production. There were perhaps 15 or 20 smaller producers during 1951. Several of these will undoubtedly develop into major suppliers.

Basic Techniques Improved

Improvements have been made on basic operating techniques. Mining is done almost entirely in open pit. Crushing and sizing are accomplished by jaw or cone crusher, rolls or impact crushers or combinations of both, followed by screening with air separation of fine dust. Screening follows standard practice, using rotaries, vibrating or Simons vertical types. All processing is dry and necessitates careful dust control, done by use of Multiclones, cyclones and spray chambers.

Perlite ore is sold on a sizing specification depending on the expanded product desired. This necessitates flexibility in crushing and screening operations and large storage facilities. A plant capable of supplying the various market requirements necessitates a substantial capital investment. This has limited to a few companies the producers of crude perlite able to compete on a wide basis. The estimated average value of $6.90 per ton f.o.b. mine for crude, sized perlite permits a profit only on a large volume of business. In design of expanding plants general improvements have been made on basic designs and methods. The vertical updraft furnace and inclined stationary appear to be most generally favored. However, horizontal rotaries and stationaries are in wide use. Some furnaces expand the perlite in direct contact with the flame; others are indirect. Fuel is gas, where available, or fuel oil, if not.

Progress has been made by the Institute and others in obtaining additional fire ratings for perlite plaster applications. Several research programs were started to further the use of perlite concrete and determine possible health hazards. A start was made on a national publicity campaign. The Institute now publishes its own organ, "The Perlite Torch." During the year the Institute received the class 1-A Grand Award of the American Trade Association Executives "for its excellent services to its industry and the public and especially for its notable educational program explaining and promoting many uses and applications of perlite. . . ."

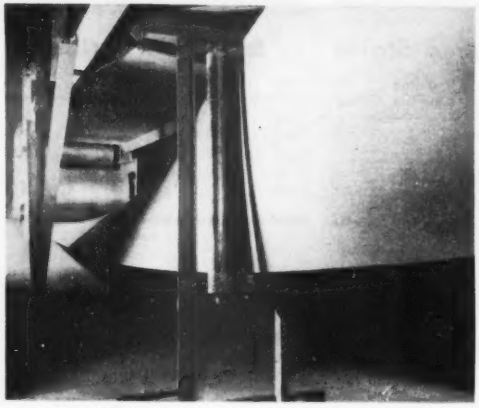
Uses Widening

The field for perlite plaster was enlarged during the year through new fire ratings. The ease of application of perlite plaster is revitalizing the plaster business.

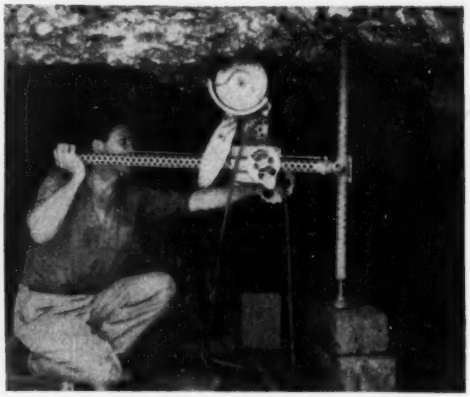
Use of perlite concrete in roof deck applications increased as more builders and architects became familiar with its advantages.

Perlite concrete floor fills, particularly under standard concrete, provide insulation and have gained in popularity. Insulating concrete in floors, walls, and roof decks of cold storage plants and as back-up behind fire brick, and other applications around kilns and various furnaces began to show promise. Application to several specialized paints, packing and filter aids increased notably.

Use of specially graded and density perlites in oil-well drilling showed gains. Here it is used with drilling muds to help restore lost circulation and in cement slurries to reduce densities which in turn reduces pump pressures. There are many other potential uses.



TWO 180-DEG. TWISTS turn Mather "B" stockpile belt completely. Guide rollers at mid-point of one turn are seen. See p. 122.



ST. CLAIR CHANNEL SAMPLER. (see p. 119) uses two motor-driven, thin diamond-impregnated wheels to cut thin parallel slots.

Underground Practice Holds to Established Trends

DRILLING—Single-use bits, carbide bits, tipped shanks and long-hole work show relative positions little changed.

BLASTING—Quick delays and spittercord provide main advance.

GROUND SUPPORT—Rock bolting practice widens.

HAULAGE AND TRANSPORT—Use of conveyors and diesel power grows, trolley haulage still predominant.

AIR CONDITIONING, DRAINAGE, LIGHTING—More attention is given to these practices that govern working conditions.

A. H. HUBBELL
Managing Editor

THE CHANGES that have taken place since World War II in underground and surface mining practice have helped many companies to exercise better control over postwar costs. This evolution is continuing. It takes time, requires repeated trial and testing. The exchange of information about the results of such experimental work is a factor in the advance achieved.

The Drilling Trend

A confused picture is still presented by underground blast-hole drilling practice. The variables are many in equipment used, ways of using it, and types of ground. Despite the great amount of work done by manufacturers and mining companies with the many bits and drills now on the market, no simple directive for general application has been formulated, nor appears likely to be found soon. The average large operator is using more than one kind of drilling medium and mode of drilling. For example, McIntyre Porcupine Mines, Ltd., in Ontario, is doing 75% of its drilling with single-pass bits, 14% with detachable carbide bits, and 11% with carbide-tipped forged steel. The situation is appraised briefly as follows (details will be given later):

Single-Use Steel Bits. Available in several types and makes, these are being used in huge quantities, particularly in South Africa. They find favor where ground is not too hard and where their use eases or eliminates the shop problem. While they have many enthusiastic users, disappointment with them is indicated in some quarters. For the various bits of single-use and other types hereafter mentioned see *E&MJ*, July, 1951, page 110.

Multiple-Use Steel Bits. These are still in the picture, though their use is rapidly diminishing. Nevertheless, the chief engineer of one bit manufacturer, considering the machined joint of the multi-use bit superior to the single-use bit's forged joint, thinks the chances of the multiple-use bit for survival are excellent, especially if carbide becomes hard to get (which has not happened to date) or its quality deteriorates.

Carbide Bits and Tips. At pres-

ent the accent is on carbide drilling, both with detachable insert bits and with tipped shanks. Carbide drilling makes possible faster penetration and use of smaller holes, with variable advantages in operation and in power and powder consumption. Technological improvements in both carbide manufacture and rock-bit manufacture have made possible a more uniform product. Use of the carbide insert bit has contributed toward solving many other drilling difficulties.

Use of carbide-tipped-forged steel shanks is increasing at present in the United States following their success on the Continent, in South Africa and Canada. (A manufacturer of single-use bits in Canada thinks there is a slight trend currently away from the use of tipped shanks in the Dominion.) An interesting application of homemade tipped shanks by the Hudson Bay company at Flin Flon, Man., has recently been described (*E&MJ*, Jan., 1952, pp. 88-90).

Alloy Drill Steel for Carbide Bits. Use of high-carbon chrome-molybdenum drill steel, such as Crucible's C A Double Diamond (C, 1%; Cr, 1.35%; Mo, 0.15%; Mn, 0.30%; and Si 0.25%) is increasing markedly. The reason given is that, with longer-lasting tungsten-carbide insert bits, there is need of a steel of fatigue life which is commensurate with the bit life. The "chrome-moly" steel is also said to be better with respect to shop practice and consistent performance than the low-carbon high-nickel steel, represented by Crucible's Park A. Such steel is no longer being melted by the former makers, Crucible and Bethlehem, because of the critical nickel situation.

With proper shop equipment the "chrome-moly" type can be satisfactorily forged, annealed, machine-threaded and hardened for use with thread-type detachable bits. This steel is also being used successfully with single-use detachable bits.

The "chrome-moly" steel described is essentially the same as Vibresist steel sold by Atlas Steels, Ltd., Welland, Ont. and the same as the steel used in making the Swedish Coromant and Seco shanks.

Drilling Experience Varied

The following cases, culled from reports of current drilling practice, are not classified strictly according to types of drilling medium. The reason is that many companies employ more than one means of drilling, depending on the specific application and character of ground, and one medium sometimes cannot be discussed without reference to the others.

Current Homestake Practice

Homestake Mining Co.'s investigations have run the gamut of multi-use and single-use bits, but currently have been reduced to Liddicoat Type L and H and Throwaway one-use bits. These three types are being employed in stoping and raising. Changeover from forged steel was completed in February, 1951.

The single-use bit gives the best cost per foot of hole drilled, but not necessarily the best overall results because a greater production per man-shift is possible with carbide bits.

Carbide bits 1⅝ in. and 2½ in. in size are used in development drifts. The 2½-in. bits are used to drill four center holes in place of a burn cut. They give some problems not yet solved. The rest of the round is drilled with 1⅝-in. bits. This combination gives faster drilling, longer rounds, and a one-shot blast in tough rock. Cost per foot is higher than with one-use detachable bits.

In stoping, the 1⅝-in. detachable carbide bits, in combination with ⅞-in. hex. drill rods and light-weight jackhammers mounted on airlegs, have been found exceptionally versatile. This combination gives greater portability and maneuverability with less consumption of air and dynamite and more footage and tons per man-shift than 3½-in. drifters on a fixed column mounting.

Detachable carbide bits are used by Homestake to some extent in sampling stope walls.

In a recent month (November), 55½% of all drilling was done with one-use bits and 44½% with carbide bits. These percentages are likely to change.

Carbide-tipped forged steel has been tested by Homestake but the inserts failed in every case before the rod failed. Costs were higher than with detachable carbide bits.

Elsewhere With One-Use Bits

M. A. Hanna Co., Iron River, Mich., is trying single-use bits and thinks a saving can be made in handling cost, bit cost, and resharpening cost.

Negus Mines, Yellowknife, N.W.T., is satisfied with Throwaway single-use bits for drifting, crosscutting, and raising. For other work the number of light airleg-mounted drills using carbide-tipped shanks increased from three to 12 within the year. Use of detachable carbide bits has decreased because of trouble with the connection.

Waite Amulet, Noranda, Que., has discontinued the use of single-pass bits.

Canadian Refractories, at Kilmar, Que., gets an average of 25 ft. in ordinary ground from the one-use bit it employs throughout the mine. This permits use of a long-feed machine to drill 9-ft. holes of small diameter with parallel holes without changing steel.

American Zinc, at Mascot, Tenn. is testing single-use bits that will fit onto 1-in. hex. steel without reconditioning of the latter other than squaring the end and tempering. **Another operator** in this general area is getting increased footage, 30% lower bit cost, and benefits of the smaller hole and better powder distribution by using single-pass bits. **A mid-Western fluorspar company** reports somewhat similar experience.

A large Western operator, using both C A Double Diamond and Vibresist alloy steel with Liddicoat bits, is grinding the bit connection and chamfering the machine end of the rod, without heat treatment on either end.

A Michigan iron ore operator is using a single-pass bit successfully in rubbly ground in one mine on the Gogebic Range. Compared with multi-use bits, drilling speed is greater, bit cost per foot less and cost of rod preparation less. There is less tendency for coarse particles of rock to bind behind the bit because of greater wing clearance, so that the rods can be easily withdrawn.

Eagle-Picher, in Oklahoma, is testing both single-use bits and carbide-insert bits to determine their advantages, if any, over the multi-use steel bit.

Bunker Hill and Sullivan, Kellogg, Idaho, is continuing the trend to use of smaller drills, smaller rods and smaller bits and is starting to use single-use Throwaway bits that bottom at 1¼ in. The value of these bits has been proved. Drills of 2⅝-in. and 2¾-in. bore will use them and steel of ⅞-in. section. Use of this light equipment will be extended as fast as the heavier drills have to be replaced. In blasting, ⅞-in. dynamite is being used.

The Liddicoat single-use bit is being produced by Western Rock Bit Co. in three basic designs and in sizes ranging from 3 in. down to 1¼ in.

The D B T Throwaway bit, similar in overall design to the Portland bit, is now being made for sale here and abroad by Drill Bit & Tool Co., subsidiary of Mackintosh-Hemphill Co., Pittsburgh, Pa. As improvements, it is claimed that the ⅞-in. socket series in the 1¼-in. size and up has a skirt 1/16 in. longer and the cutting teeth have 1/16 in. additional overhang. A steel is used in the bit which gives greater hardenability penetration and more uniform hardness, assur-

ing a cutting edge of 63-65 Rockwell and a skirt hardness of 33 Rockwell. The latter prevents skirt breakage. The added skirt length is intended to give greater adherence to the rod.

The "P.M." Handbook, 33 pages, published in 1951 by Rip Bits, Ltd., Sheffield, Eng., is intended to aid users of the "P.M." single-use steel bits to get maximum value from them.

Results With Carbide

A large mining company in the Western States is experimenting with carbide insert bits with a Liddicoat connection.

Getchell Mines, Nevada, has tried two types of detachable carbide bits in drilling hard tungsten ore, chiefly tactite. The first gave much trouble through wringing of the skirt and breaking inserts out of the bit. The second gave better results in these respects. The report demonstrates the variation in bits available. Getchell's chief benefit has been a bigger footage per man-shift.

M. A. Hanna Co., at its Iron River, Mich., mines is making limited use of detachable carbide bits where drilling is hard, and of carbide-tipped steel in drilling raises.

Tennessee Copper Co., Ducktown, Tenn., has results from test work with Timken detachable carbide bits that indicate an extension of their use on a 100% basis this year.

U. S. Smelting, Refining & Mining Co., Utah, has adopted airleg-mounted jackhammers with carbide-bits for stoping at Ophir with satisfactory results—also reports a more limited use for stoping at the U. S. and Lark mine.

In an iron mine at Ely, Minn., on the Vermilion Range, detachable carbide bits have proved satisfactory and are being used throughout. The program was started in 1950. Tests with tipped forged steel will be made early in 1952.

Shenandoah Dives, Colorado, is using Timken detachable carbide bits on mounted machines, effecting important economies. Such bits show definite savings with stoping machines in hard, even ground, but have not taken over the work in uneven ground. A campaign of testing carbide-tipped forged shanks is scheduled to start soon.

A large mine in Western Canada is making a gradual change from 1⅛-in. carbide bits to 1⅜ in. size, with accompanying change in rods from 1-in. Q.O. to ⅞-in. hex. This gives better results in medium-hard ground and may prove better in hard ground.

Tungsten carbide bits have produced notable improvement in development efficiencies for **Rhokana Corp.,** Northern Rhodesia, according to E. K. McDermott, in *Bull.*, I.M.M., Nov. 1951. The advance per African and per machine shift has increased by approximately 50%. Tests on the use of percussion drills and tungsten carbide bits for long-hole drilling are in hand.

At John Taylor & Sons' Nundydroog mine, at Oorgaum, South India, where mining conditions are most difficult, tests with carbide drilling have given good results. They have been described by V. M. Sundra Rajan before the Kolar Gold Field Mining & Metallurgical Society. Mr. Rajan finds:

(1) It would facilitate the operators' work if manufacturers would provide more information about the grades of the inserts.

(2) The airleg combination and carbide-tipped steel have cut drilling costs more than half.

(3) The saving in labor, capital and maintenance costs is substantial.

(4) Footage advance per month is increased by more than 50%.

(5) Number of machines required and air consumption are reduced. It is possible that higher air pressures may be achieved with present compressor capacity and air lines.

(6) Output per man-shift and machine-shift is greatly increased.

(7) The standard machine used has given encouraging results and progress with carbide bits need not be held up for lack of more modern equipment.

Successful experiments in brazing in spare inserts have been made at the same company's Mysore mine.

The Best Combination. A. J. Zinkl, assistant superintendent of Shattuck-Denn's Iron King mine, stated at the Mining Congress' Los Angeles meeting that, upon completion of tests involving 12,000 ft. of drilling with destruction of 105 tungsten-carbide bits, a cost analysis showed that a 98-lb. stoper with ⅞-in. drill steel and the 1½-in. bit gave appreciably better results than any other combination, such as the customary 116-lb. stoper, 1-in. steel, and 1⅝-in. bit.

Tests at the Soudan iron mine, Minnesota, according to Earl M. Holmes, assistant superintendent, at the same meeting, have shown that work now being conducted with light drill machines and tungsten-carbide bits give promise of cutting drilling costs by about 35% in at least part of the ore stopes.

Opinion of drill manufacturers should be a useful guide. N. W. Reinker, speaking for LeRoi's Cleveland division, writes: ". . . the trend is to the tungsten-carbide insert bit . . . . we have found that a drill that delivers a light fast blow with a speed which will not overcrowd the bit at the drilling face gives longer life to the bit and increases drilling speed."

Gardner-Denver's C. N. Ruyle writes: "Because of continued improvements in carbide bits, many operators are finding that larger machines can be used than originally anticipated, although the trend with carbide bits generally is to smaller drills than originally used with steel bits."

Holman Brothers, Camborne, Eng., advise that, in a tunnel in the north of England, 530 of their detachable carbide bits (Holbits) drilled 451,000 ft., averaging 850 ft. per bit. In harder rock in an Indian tunnel these bits averaged 351 ft., against 200 ft. for tipped steel. Demand for the bits has increased despite larger sales of tipped shanks.

Use of Tipped Steel Widens

Carbide-tipped forged steel was first introduced to Western Hemisphere mining about three years ago, when Atlas Diesel, Ltd. of Stockholm established its subsidiary Canadian Copco, Ltd., at Kirkland Lake, Ont. Use of this steel, in combination wih light drills set up with an airleg, soon found favor at many Canadian mines, as reported in *E&MJ* at various times. The interest created induced similar interest in the United States and led to production of tipped forged steel in various lengths by at least two manufacturers (Rock Bit Sales & Service, Philadelphia, Pa., and O. J. Black, Bishop, Calif.); also by certain mine operators, and in 1950 led to the establishment by Atlas Diesel of a subsidiary, Copco Pacific, Ltd. now at San Carlos, Calif. More recent developments are as follows:

Canadian Copco states it is servicing over 1,000 drills with parts and Coromant steels. Its head office is in Montreal where it is starting a rock-drill factory. (Sandvik Steel Works, Sweden, have also opened a plant in Montreal for making Coromant rods.)

For 1952, as in 1951, the Canadian company states its objective is to prove the validity of the principle of drilling small holes for breaking ground. It believes that drill holes should be as small as possible, for greater speed and less wear on equipment. It claims that speed is raised about 40% when

bit size is reduced from 1½ in. to 1-1/3 in. It is working experimentally with tungsten carbide bits down to 1 in. dia. The main difficulty has lain in powder sizes available plus technical difficulties of getting satisfactory explosive in ¾-in. and ⅞-in. sizes. The dynamite manufacturer is cooperating.

The company also claims that one large base metal mine recently drove 626 ft. of 9x9 ft. drift on a 3-shift basis in 30 days using their equipment. It states it is developing round patterns for customers based on small holes. It hopes to break resistance down in camps where large-diameter cut holes were pioneered. During 1950, it claims, various operators adopted its equipment for stoping and shaft sinking. In 1951 much of its work was to prove the application to drifting. It also claims success in raising.

According to Copco Pacific, in California, more than 13 mining companies in various Western states have some of its drills and tipped rods in service.

Various operators who are trying carbide-tipped steel or who are continuing with it after trial, describe the practice as follows:

Sigma Mines, Ltd., Quebec, has applied the Swedish light drilling equipment to drifting. Heretofore it was not feasible to bore the large cut-hole required. Success has been had with a 2⅝-in. four-wing detachable carbide bit with Holman-type attachments, made by Climax Rock Drill Co. In quartz, smaller holes can be used for cut holes. Two 2-in. holes drilled with tipped forged steel are adequate.

Waite Amulet, at Noranda, Que., is using carbide-tipped steel in all rock work in shafts, drifts and sublevels. Results are not so good in sulphide ores. Detachable carbide bits are in general use in raises.

East Sullivan, Quebec, has bought four light Atlas drills to replace bar-mounted leyners in a shrinkage stope. Tons-per-shift have increased. Craig tipped steel is being tried with stopers in shaft sinking with encouraging results.

An Ontario base metal company is drilling about 40% of its footage with carbide-tipped steel and airleg machines. Cost compares favorably with that obtained with 3½-in. leyners and one-pass steel bits. Savings are due to greater drilling efficiency and better use of explosives. Carbide-drilling situation is in a state of flux. Improvements in drills, rods, and carbide can be expected, so no standard has been adopted. Tests indicate that for the softer ground detachable steel bits equivalent in gage to the carbide bits may give lower cost per foot drilled.

Algoma Ore Properties, Wawa, Ont., has tried chisel-type tipped forged steel with success, detachable bits having failed in the connection. Four-wing bits now replace the chisel-type. Penetration is the same, hole deviation eliminated, gage loss less, and life 40% longer.

Hudson Bay Mining, Flin Flon, Man., is making its own four-wing carbide-tipped steel and using it to good effect at a big saving. See article in *E&MJ*, Jan., 1952, pp. 88-90.

Roan Antelope, Luanshya, Northern Rhodesia, is changing from ⅞-in. hex. to 1-in. hex. carbide-tipped forged borers to reduce breakage and drill maintenance.

Knob Hill Mines, Washington, is advancing a 5x7-ft. drift 7 ft. per shift with carbide-tipped steel, compared with 5½ ft. using leyners and detachable carbide bits.

Sidney Mining Co., Idaho, has used carbide-tipped steel in small quantity, but has not found it attractive enough to displace the detachable carbide bits that do most of the drilling.

Mountain Copper Co., Matheson, Calif., is still making its own carbide-tipped forged steel with some success and about half of its detachable carbide bits. More use is being made of the airleg and light R38 stopers. The one offset leg PR38 stoper in service is liked because of the longer (44-in.) steel change.

American Smelting & Refining, Mexico, is increasing its use of light airleg drills and tipped steel and getting a considerable increase in footage per machine shift.

O'okiep Copper Co., South Africa, has gone over extensively to 2⅝-in. I-R Jackhamers mounted on Jacklegs for development drilling and stoping. The lighter equipment is popular in that it is easier to handle, can be set up and torn down more quickly, and permits drilling extra holes, improving footage per round. Greater use is anticipated.

Benefits of Making the Holes Smaller

The advantages that can be derived in many instances from the drillhole diameter are inherent in drilling with carbide bits or tipped shanks, thanks to the way carbide keeps its gage.

One operator questions the value of the smaller hole in all cases, pointing out that in some rocks it may be very desirable to get a larger amount of powder in the bottom of the drill hole than the hole diameter will permit.

It should be remembered, incidentally, that drilling of "small" holes with steel bits antedated the introduction of carbide for drilling, at least on this side of the Atlantic.

Results obtained by an Ontario operator in drilling with one small steel bit, not obtainable today, are interesting:

After preliminary tests in 1943 and 1944 with a cross-type 1½-in. dia. steel bit which had a ½-in. dia. center hole and was threaded to fit a stud swaged into the rod, the company decided to adopt it for its operations. Its experience up to the end of October, 1951, was as follows:

New bits into service ...	485,617
Bits reground	2,340,099
Footage drilled	4,523,861
Average usages per bit ..	5.82
Average footage per bit ..	9.32
Average footage drilled per sharp bit usage ..	1.6
Total number of rods used	58,965
Average footage per rod	76.7

These bits have been used chiefly with 3-in. drifters and rods of ⅞-in. Q. O. alloy steel. Average footage of 76.7 per rod tabulated is thought reasonable because the only new steel used is for 7½-ft. lengths, all other rods being made from salvaged steel. The company is now experimenting with tungsten-carbide bits.

Long Hole Drilling Shows Few Changes

The practice of drilling long blast holes underground, whether with diamond drills or with rock drills using coupled rods and carbide bits, exhibits few changes. DeBeers Consolidated Mines, South Africa, has developed a procedure for diamond drilling long blast holes without use of water (*E&MJ*, Nov., 1951, p. 90) as a sludging medium. MacDonald and Gallie (*Bull.*, C.I.M.M., Jan., 1951) describe the operation underground of three diesel-driven diamond drills at Lynn Lake, the emphasis being on the effect and disposal of the exhaust gases.

A major change that has taken place in the mining practice of Rhokana Corp., Northern Rhodesia, over the 10 years ended June 30, 1950, has been the adoption of diamond drilling for blast holes, according to E. K. McDermott in *Bull.*, I.M.M., Nov., 1951. At first it was used only for recovering pillars but now for almost every stope. Successful experiments with BX instead of EX non-coring crowns have been carried out.

New Standards Set up fogr Diamond Drilling. R. D. Longyear says that the number of diamond-drill holes over 3,000 ft. deep in North America increased in 1951. There

has been much discussion concerning the need for additional deep drilling. Scenes of recent deep holes are in Michigan, New Jersey, Pennsylvania, and Ontario.

Three main improvements are embodied in equipment for deep holes. They are: (1) kelly drive; (2) 5-ft. or 10-ft. hydraulic feed; and (3) powerful, high-speed hoist.

Diamond Core Drill Manufacturers Assn. has established a new series (U Series) of drill rods, designed to fill the drill hole more completely. The diameters are given in the table. Thought has also been given to the thread specifications and decision made to standardize on a modified stub acme thread. Advantages of the larger diameters are an improved stabilized drill string, less vibration, less caving ground, more rapid return of sludge, and larger water passage through the coupling.

These standards have been set up as "research standards," which means that they are tentative until thorough field tests have been made. Some manufacturers are making the new rods so that they will be available for their own contract drilling department for field testing and for some of the customers who wish to purchase them.

Diameters of U-Series Drill Rods

Hole	Rod Diameter Present	Proposed
EX—1¼ in.	E—1 15/16 in.	EU—1⅞
AX—1 15/16 in.	A—1½ in.	AU—1¾
BX—2⅜ in.	B—1 29/32 in.	BU—2 3/16
NX—3 in.	N—2¾ in.	NU—2¾

Mounting of diamond drills on trucks and trailers tends to increase. This saves many hours in moving from hole to hole. An iron mining company in Minnesota has mounted some drills on large steel scows, complete with shanty, mast and pumps, so that they may be readily hauled by tractor.

Success has been had by substituting the use of rock bits and mud-laden fluid for the conventonal stand-piping techniques in drilling glacial drift. Capital investment as well as costs per day for supplies and depreciation are increased but are usually offset by the greater progress made.

Continuing efforts are being directed on the Colorado Plateau towards improving core recovery in drilling carnotite ores. Rock bits and compressed air for circulating medium have been used in some instances for drilling the formations above the carnotite.

The Diamond Research Laboratory, Johannesburg, has developed the practice of using a diamond saw for splitting drill cores evenly and cleanly. (*E&MJ*, Nov., 1951, p. 110.)

Preliminary studies of the orientation of diamonds in diamond bits intended to improve the efficiency of diamond drilling have been undertaken by the U. S. Bureau of Mines (R.I. 4800, June, 1951). They indicate that with proper orientation, the drilling performance is increased and the diamond loss per unit of work done is greatly reduced.

A Substitute for Diamond Drills. Use of rock drills, coupled rods and carbide bits has been successful where holes have not exceeded 60 ft. in depth, cost of diamonds per foot is high and the rock hard. A Quebec company is maintaining a ratio of one diamond drill to four rock drills.

Gardner-Denver observes that there is a strong trend toward hammer drills for long blast holes because of lower costs. This is made possible by the use of carbide bits.

The experiment begun last year by **an Ontario company** in using coupled rods and carbide bits for sill recovery has become standard practice and yielded savings over the use of diamond drills for this work. Equipment included a 4-in. leyner, 1¾-in. and 2-in. four-wing carbide bits and 1⅛-in. by 4-ft. rods. Use of the extended water tube in the leyner and the "O" ring in the chuck rod have eliminated the use of the water swivel.

M. A. Hanna Co., at Iron River, Mich., finds coupled rods and carbide bits useful in drilling long holes in some areas, saving time in bit changing.

An Iron Country operator continues to drill long blast holes with coupled rods and steel bits. The ore is soft. The same company in a New York operation is gradually changing its stoping from benching with jackhammers to long-hole drilling with sectional steel, carbide bits and drifters, using ring-seal shanks.

Elimination of "squaring" of drill holes and bits in long holes drilled with percussion machines has been accomplished by **Howe Sand Co.** at Holden, Wash. A 1¾-in. collar is forged on the lead rod about 6 in. from the bit end. If necessary, the collar is turned to proper size in a lathe. The same operator, at its Snow Lake property in Manitoba, is getting more footage with no decrease in drilling speed by using more 2⅛-in. bits rather than 2-in. bits.

In its long-hole drilling, **Algoma Ore Properties, Ltd.**, Ontario, uses rods in 4-ft. lengths for 4-in. rock drills and 3-ft. lengths for 3½-in. machines. Using 4-ft. and 3-ft. shells, respectively, they have cut rod-changing time considerably. A fillet behind the 1¼-in. threads, on 1⅛-in. rods, has eliminated thread failure, reduced coupling failure to a minimum, and eased the breaking of the joint. Worn threads are ground off and the rods bumped up and rethreaded with slight loss of length.

Two-inch carbide bits directly coupled to rods with reverse buttress thread have been replaced by Algoma with bits seating on the shoulder of a short adapter having a diameter approximately equal to that of the bit skirt. This factor, together with a harder carbide, has increased bit life, improved sludging, eliminated rifling of the hole, and reduced gage loss. Trial is being made of 2½-in. bits, giving ⅝-in. clearance over the couplings. They give promise of better sludge clearance, less stuck rods, and reduction of blowouts in "O" rings.

Use of Jumbo a Factor in Improved Drilling

The favor enjoyed by jumbos for carrying already-mounted drills to the working face continues to increase. In general, where labor conditions and driving speed warrant, hydraulic drill jumbos with long-feed drifters are favored. The trend to longer drill feeds is a result of the availability of carbide bits and improved small-gage steel bits.

Acceptance of the jumbo comes about because drill designers seem to be approaching the possible maximum drilling speed per pound of drill weight and, if further improvement is to be made in the drilling operation, it must come from a different source. The jumbo permits the drill to be in operation a greater part of the time available, saving the time that would otherwise be required for setting up and tearing down.

Working in this direction, the Joy company has had success with its hydraulic drill jibs. Its latest model has not only a hydraulic raise and lower, but a hydraulic swing horizontally, with a self-locking feature due to the fact that a double-acting hydraulic cylinder is used. Various designs of its "Drillmobiles" incorporating the drill jib have made possible a bigger overall footage and, in many cases, have doubled the footage per shift.

The same company has been experimenting with a self-propelled, rubber-tired mounting which carries a double jib that mounts a feed up to 20 ft. in length. Several units are being built for use in toe-holing in stripping copper

ore in open-pit operations in the Southwest. The same arrangement is being used in underground limestone quarries where it has increased footage over that obtainable by present methods from 50 ft. to 100 ft. per hour. This new double jib is very flexible and permits the driller to drill the rib holes on either the right or left side of the room.

The hydraulic jib is being used on large jumbos outside the mining field. In a tunnel that, when finished, will be 50 ft. in dia., a jumbo is being used that mounts 17 drifters, each with a 6-ft. speed and mounted on a hydraulic drill jib.

The Coy "Hobo," a self-powered, rubber-tired, one-jib jumbo developed at Mascot, Tenn. by H. A. Coy, manager for **American Zinc Co.** (described in *E&MJ*, Feb., 1951, p. 113), has chains on all four wheels, each put on individually as an auto tire chain. Mr. Coy says that the chains function remarkably in climbing and protecting the tires. He expects to build another machine with a longer wheel base and possibly a different arrangement of the chains.

Jumbos carrying two booms are in use at **M. A. Hanna's** Iron River mines, Michigan.

A Tennessee zinc operator reports 15% improvement in development footage using a jumbo. A fluorspar company has found that installation of two jumbos in drifts and crosscuts gives a saving in manpower, makes setting-up quicker, permits longer rounds to be drilled.

International M. & C.'s potash mine, Carlsbad, now has rubber-tired-mounted 2-drill jumbos. Two men using carbide bits on one of these machines can drill as many holes as five men can drill equipped with the present post-mounted drill. Drilling speed is 8 fpm.

New Park Mining Co., Utah, uses a one-drill jumbo mounted on a home-made truck and built with a spring-supported deck that jacks down on to the wheels to eliminate drilling vibrations in axles in bearings. Leyners on 5-ft. aluminum shells with detachable carbide bits permit drilling a hole with only one change.

Chief Consolidated, Eureka, Utah is using high-speed portable 350-cfm compressors (at 110 lb.) to boost pressure in working areas to maintain an average of 100 psi at all faces.

A second iron ore operator in the Birmingham field will install a self-propelled crawler (or rubber-tire-mounted) jumbo. U. S. Steel's T.C.I. Division has been using such jumbos with its trackless mining for some time

At Butte, most headings are using one, two, or three-jib jumbos, with 4-in. power-feed drifters having 4-ft. shells.

On the other hand, **Algoma Ore Properties,** in Ontario, reports that jumbos have been eliminated through introduction of airlegs for all lateral development.

Gardner-Denver states that for inaccessible workings, small headings and small mines the trend continues toward use of jackhammers mounted on air-feed legs.

For taking channel samples, the St. Clair sampler (South Africa) uses two motor-driven, thin, diamond-impregnated wheels which cut thin parallel slots along rib or across vein. In quartzite they can do 4 to 6 in. per minute. The sample is then broken out with a chisel. This was first done by Union Corp. See p. 114.

A New Machine for Dry Drilling

Outstanding among new drills is Holman's Dryductor, designed so that, while drilling dry, it avoids loading the working-place air with fine dust. This is done by drawing the chips and dust through the bit into the hollow drill steel and passing them back through the steel and the center of the drill itself to a disposal hose at the rear. The removal system provided is without restrictions or changes of direction to impede the dust flow. Collection is effective from each and every hole irrespective of where it has been collared. The hole collar moreover is never hidden. The machine's chief field is where wet drilling can be arranged only with difficulty or will be unpleasant for the driller. For roof bolting the machine is mounted on a type of air-leg that permits drilling vertical holes where headroom is limited. Tests made by St. John del Rey Mining Co., in Brazil, have been satisfactory. The test machine has proved to be 15% to 20% faster in drilling per foot than the drill then in use.

The Konigsborn drilling dust exhauster, introduced by Columbia Technical Corp., New York, creates a vacuum which draws dust-laden air out through the hollow drill steel. The vacuum is produced by feeding compressed air through a valve in the injector.

Blasting Practice Keeps Pace With Drilling

Use of millisecond delays is well established as orthodox, though far from universal, blasting practice underground. Their advantages of better fragmentation and powder economy can express themselves in terms of lower costs. The importance of their ability to reduce shock depends on circumstances. The hazard of flying rock is somewhat greater.

Increasing use of spittercord, under various names, for spitting the fuses of a round in safety is noted. A typical case is that of Park-Utah Consolidated, in Utah, where Ignitercord and ordinary fuses are used in dry places when there are many holes to blast. In sinking a wet shaft, however, electric delays are used, each half connected in parallel and the two halves in series, a heavy magneto being used for firing.

Use of detonating fuse underground, specifically Primacord, merits attention. Inquiry made to 60 operators throughout North America reveals that 16 employ it to a varying extent, as follows:

In a large British Columbia mine Primacord is found suitable for blasting hung-up raises along with a short fuse, eliminating the long delay and heavy-smoke experienced when only fuse is used. Where formerly used for diamond drill blasting, it has been displaced by quick delays. . . . **A Michigan operator** uses it in three mines where holes are drilled in sublevel stoping, also in sublevel caving where holes are drilled to reach the cave These holes vary from 10 to 20 ft. in length.

Hudson Bay Mining & Smelting Co., Flin Flon, Man., uses half a million feet per year, or 0.36 ft. per ton blasted, chiefly for double-priming sublevel ring blasting.

Fanned holes are drilled 30 to 60 ft. long in one of the lower quadrants of a 5x7-ft. footwall or hanging-wall sublevel drift. Each hole is primed by an electric detonator, not more than 20 of which are in series, and each group of 20 is connected in parallel. Primacord is used as a second primer in each hole and all holes in the same group (using the same series delay detonators) are connected. Usually the Primacord extends as far as the first five sticks of powder, which may be 5 to 20 ft. from the collar. Although the electric detonators should completely detonate the ring, if any one or several detonators fail, the Primacord will detonate the remaining holes. Misfires which might result from single priming have been reduced by this double priming but the reduction would be difficult to estimate. Primacord is also used, but to minor extent, in blasting "hung up" finger raises where more than one shot is required to fire simultaneously.

At Barnat Mines, Quebec, Primacord has been used since 1938 in diamond-drill hole blasting in holes over 15 ft. long, and in fractured ground where there is danger of cut-offs. More recently it has been used in cut-

and-fill stoping in blasting large boulders together. . . . **Normetal Mining Corp.**, Quebec, uses it for all blasting in timbered raises, chiefly for safety. . . . **Canadian Malartic** used it in long blast holes 12 years ago but results failed to justify the cost. . . . **Waite Amulet**, in Quebec, also has discarded it. It required a larger hole than necessary, cost more than electric caps. . . . **Sidney Mining Co.**, Idaho, will try Primacord in future long-hole pillar blasts (if there are any), using it full-length in each hole, detonating each one individually by a quick delay.

Climax Molybdenum Co., Colorado, makes extensive use of Primacord underground, mainly in secondary blasting, where a number of adjacent plaster shots or bundle shots may be exploded simultaneously. . . . **Mountain Copper Co.**, California, uses it in all long-hole blasting, also for difficult blasting of hung draw holes. It is run the full length of the long holes to improve propagation of the explosive wave. These holes are now being fired with millisecond delays, getting better fragmentation. Maximum length of the long hole is 90 ft. Primacord is used in holes as short as 20 ft.

Cleveland-Cliffs Iron Co.'s current consumption of Primacord is about 110,000 ft. per month in its Michigan underground mines. Results are an improvement in the "ragged" long holes drilled in breaking ore in initially opening the caving blocks, in sublevel stoping, and, to a more limited extent, in sublevel caving. The practice of using Primacord in holding cutoffs to a minimum in the powder train of these long holes has increased materially. . . . **U. S. Smelting**, Salt Lake City, uses Primacord occasionally underground in regular slabbing and breast rounds where ore breaks large and better fragmentation is necessary to prevent breakage of stope timber. Total consumption does not exceed 10,000 ft. per year. . . . **Dome Mines**, Ontario, has used Primacord at times for test purposes only within the last year. . . . **At an iron mine**, New Jersey, Primacord is used in shooting all holes 25 ft. long or longer. It has eliminated powder in bootlegs and cutoffs. Management is still working on an electric cap with a long leg wire to make the primer the first cartridge. . . . **Eagle Shawmut**, California, uses Primacord for cutting up timbers, pulled with old stope fills so they can be handled.

Asarco Mining Co., Chihuahua, Mex., has used Primacord in recovering pillars at Sta. Eulalia. In blasts of 40,000-60,000 tons each it has aided in complete detonation of the powder charge. Holes per blast, 400-500, averaging 35 to 40 ft. Powder used, 5,000-7,000 No. 2 Gelamex per blast. Millisecond delays used, 25-50-75-100-125 and 150 ms. In loading, a length of Primacord was attached to a stick of powder in hole bottom, the other end hanging several feet out of the collar. Rest of the powder was then loaded four sticks at a time and tamped. Detonation by millisecond delay.

Tennessee Copper Co., Ducktown, detonates practically all stope holes with Primacord to eliminate misfires. In ring drilling a 30-ft. length of Primacord is run into each hole and the outer ends are connected to a trunk line of Primacord which is detonated with one electric blasting cap.

Increasing use of millisecond delays is being made by Homestake Mining Co., as part of the program it has in hand for doing more continuous drilling in stopes for several successive shifts, using Jacklegs. Blasting is then done electrically with the quick delays. Much remains to be done.

O'okiep Copper Co., South Africa, has done much work with millisecond delays and finds that powder consumption for secondary breaking is less and that concussion and vibration have decreased.

Roan Antelope, in Northern Rhodesia, has partly replaced Cordtex detonating fuse in stopes with millisecond delays to obtain better fragmentation.

At its Carlsbad potash mine International M. & C. Corp. has improved its blasting practice. In place of the bulky, heavy reels operating from a 220-v. ac circuit which it has used from the start, it now has a light blasting box which can be attached to a shuttle car. This consists of a condenser energized by two dry cells. Blasting is done by connecting the unit to the blasting circuit. This is safer, cheaper and more efficient. The drill round pattern has also changed.

Smaller Powder for Smaller Holes

As a result of drilling smaller holes (see p. 115) **Bunker Hill & Sullivan**, Idaho, is down to ⅞x8-in. powder size. This represents a definite saving in explosive costs. . . . **Knob Hill Mines**, in Washington, has also cut powder consumption by using ⅞-in. powder.

For loading holes drilled with 1⅝-in. Carset bits **Sidney Mining Co.**, Kellogg, Idaho, has standardized on 1x8-in. cartridges. But on blasting a shaft round of the 1⅝-in. holes, fragmentation was unsatisfactory until 1½x8-in. sticks of 60% ammonia gelatin were substituted for the 1x8-in. 60% dynamite. The larger sticks fill the hole so that no water pockets are formed when the cartridge mushrooms on tamping and so they give a higher loading density.

Crossovers for Safety. Use of "crossover" plugs for final connection of rounds blasted electrically by Chief Consolidated Mining Co., Eureka, Utah, is a safety precaution. They consist of a female plug in the blast line on one side of the drift and a male plug opposite (Joy String-a-Lite), both being a safe distance behind the face. When connected they form a barrier across the drift.

For secondary blasting in the Butte mines, a compressor mounted on a small truck speeds up drilling.

Plastic Pipe for Tamping. Mining companies in Canada using Carlon "E" ¾-in. plastic pipe for tamping sticks include International Nickel, Algoma Ore Properties, Hudson Bay Mining and Smelting, Quemont, Pamour Porcupine and Falconbridge Nickel. Some of these companies have started to use the ½-in. size due to the introduction of Swedish drilling equipment which takes steel of smaller diameter. Sales agents for Micro Plastics, Ltd., of Acton, Ont., who make the pipe, are Beardmore & Co., Ltd., of Toronto.

Half-inch IPS hardwood-tipped aluminum-alloy tubing is used in loading holes at Knob Hill Mines, in Washington.

A Blasting Aid

A new blasting meter, the V.A.O., a combination voltmeter, ammeter, and blasting galvanometer for field use, has been announced by Hercules Powder Co. It is made by Roller-Smith Co., Bethlehem, Pa., and embodies features suggested by Hercules engineers. It has these important features:

1. It contains the necessary electrical components adjusted to specific ranges for checking stray currents and voltages around blasting operations.

2. It has a rectifier and can be used for detecting either ac or dc and voltages.

3. It can be used as a blasting galvanometer for checking the circuit of individual electrical detonators or detonators connected in series.

Economy is anticipated in the operation of the combination electric-and-diesel self-loading transports developed in American Zinc L. & S. Co.'s mine at Metaline, Wash. These are designed to permit quick conversion to stope-drilling jumbos.

Developments in Loading Haulage and Transport

Trolley and battery locomotives are probably handling more tonnage underground than any other means of transport. Conveyor transport is steadily increasing its proportion of the total. Diesel-powered trucks outrank diesel locomotives underground in the United States in the duty they perform, though the latter have a better chance of multiplying underground. Miscellaneous transportation accounts for tonnage remaining. Figures are lacking.

The trend to larger locomotives where the tonnage warrants is noted. The Steel Corp. in Birmingham is using 32-ton units and replacing the 60-lb. rail with 90-lb., thereby permitting greater speed with lower maintenance costs. It has also introduced flexible rubber trolley shielding. International Nickel has 20-ton locomotives in service. The Greater Butte Project will have 10-ton locomotives. These are all primarily of the trolley type which is favored for big tonnages over long distances. International Minerals, at Carlsbad, is laying 75-lb. rail on its main line, joints being welded by the thermit method, and is installing car-spotting hoists to cut out a motor and its crew.

Other than this, only details are gleaned by our survey. An Adirondack iron mining company is converting storage battery locomotives to trolley units as fast as materials can be gotten, because of increased haulage distances. Park Utah Cons., in Utah, is using a two-wire trolley system without a rail return for main-level haulage, purely for safety's sake. Diesel locomotives are mentioned more and more.

Diesel Haulage Progresses

Diesel Locomotive Approved. Step by step, sponsors of the use of diesel haulage underground are nearing their objective. Approval has been given by the Bureau of Mines to a 10-ton diesel locomotive developed by National Mine Service Co., Pittsburgh. This locomotive is powered by a 100-hp. 4-cycle Hercules diesel engine of the solid-injection compression-ignition type. It is equipped with a Twin Disc hydraulic torque converter. Samples of exhaust gases were satisfactory in respect to content of CO, CO_2 NO_2 and aldehydes.

Independently of Bureau approval, the number of installations of this type of haulage unit is growing. Plymouth Locomotive Works has been pioneering a line of diesel locomotives ranging from 3 to 70 tons, equipped with the hydraulic torque converter. Longer life is claimed for the locomotive, cars and track. Howe Sound's Calera Mining Co., in Idaho, is using this type. Various installations of Ruth units have been noted, particularly in U. S. Steel's Universal Exploration mine in Tennessee where they are hauling 50-75% more tonnage. British manufacturers are active in efforts to widen their market. New installations are reported in Ontario and Quebec.

Air Haulage in Use

The Flexible Air Trammer. — Mancha's air trammer, made by Goodman, is a simply designed, inexpensive locomotive for replacing hand-tramming on short hauls where tonnages involved do not justify electric locomotives. It is powered by air stored in its receiver which is charged by air mine pressure. An over-all width of 40 in., length of 84 in., and 55½ in. height permits its use practically any place that a mine car can go. It will travel over bad track and around short-radius curves. For lowering down a small shaft the 45-cu. ft. receiver and chassis of the locomotive can be handled separately.

Knob Hill Mines, Washington, has installed Air Trammers in two main haulage levels, with a third on order. This will cut the demand for manpower.

Two compressed-air-driven locomotives are used by **an Ontario base metal company** for miscellaneous haulage where it is impracticable to use a battery locomotive. Given good track conditions, these units will haul their rated loads in a satisfactory manner.

At an Ontario gold mine daily tonnage required a 3-ton locomotive. Haulage alternated between two levels and the shaft was too small to cage a locomotive of that size. The solution was to connect two 1½-ton Little Trammers in tandem. This provided sufficient weight, a total battery of 27 kwh, and a drive direct to four axles for improved wheel-rail adhesion. Further, each unit because of its short caging length, could be easily moved from level to level.

All Granby-type cars are being equipped with a self-cleaning device by Roan Antelope Copper Mines, Northern Rhodesia, to reduce dumping time and remove the need for blowing the cars out . . . By removing the dumping mechanism from a mine car, thereby making it doorless and increasing its capacity 30%, and developing a car dumper, the Chief Consolidated Mining Co., Eureka, Utah, has raised its tramming and hoisting capacity, eliminated spillage and cut car and maintenance costs.

Trackless Mining Gains

Improved Trackless Equipment. Shuttle cars and loaders are being operated on steeper grades—up to 12 deg. in some Western (coal) mines. To this end the Joy company is producing cars with bigger horsepower traction motors and electric dynamic braking. High-speed high-capacity diesel-electric cars can also be had for operations where tonnage is high and the haul long.

Abrasion-resisting wear plates have been installed on the body sides of shuttle cars in use in Birmingham iron mines to improve the car life.

The first diesel-electric shuttle car to be approved by the U. S. Bureau of Mines for operation in non-coal mines has a three-cylinder diesel engine which drives a generator. In turn this generator supplies power to the two traction motors and to the conveyor motor. Approval was granted Sept. 17 last. A scrubber, using water, cools the exhaust gases. No provision is necessary to eliminate carbon monoxide because the small amount liberated can be diluted safely by adequate ventilation. The diesel fuel oil must have a flash point higher than 140 deg. F.

A new cable-reel, steel-track-laying shuttle car of 6-ton size, that has a turning radius of 14-16 ft., has been introduced by General Electric. It provides for light ground-loading pressure per square inch by distributing weight over a large ground area. It is turned by locking one track completely. Because no clearance is required for turning the wheels a much wider conveyor than ordinary can be built into the body for the same overall width. The new car can be unloaded quickly as a result. Thus far it has been used only in coal but has been designed for handling heavy, abrasive ores also.

High Loader Performance. Joy's 18-HR-2 heavy-duty rock loader, used in driving a tunnel, has enabled the contractor to cut his loading time compared to that required

with other available loading equipment.

Changes are being made in the loader manufactured by Clarkson Mfg. Co., Nashville, Ill., which has been supplying the coal industry, to make it suitable for the metal mining field.

At M. A. Hanna's Michigan mines, 120-cu. ft. cars are being provided as new levels are opened up. They need to make fewer trips, cost less to maintain. Those in main level development can be loaded more fully with Eimco 40 loaders They are dumped with an air cylinder, either from below the level or with a hook. Trolley haulage is used with dc power from surface. New trolley units are of 8-ton size. Cable reels are being tried. A 2-ton battery motor serves where the wire has been removed, and is moved from level to level.

Eagle-Picher, in Oklahoma, is using several different makes of diesel-powered loading machines to determine the one best suited to the local conditions. The manufacturers are cooperating in following the monthly performance of their machines with the idea of improving them where structural weaknesses are revealed.

At Mascot, American Zinc is mucking with a Model 104 Eimco rocker shovel in sinking an incline on a 11½% grade.

In the Birmingham district an independent operator has installed a trackless loader.

Continuous Mining Progresses. Use of mining equipment of the "continuous" type has become well established in the coal industry. The Joy machine is reported to be working in seams pitching 9 to 14 deg. Two Continuous Miners have been shipped to the potash field and more are said to be on order. After a thorough test, the Pacific Coast Borax Co. has five of these machines for its new operation.

Of interest to owners of rubber-mounted equipment is the news that increases in life and low operating costs can be obtained for tires used in underground mining and run at low speeds by substituting 100% water filling for air. This has been shown by tests made by Goodyear Tire & Rubber Co.

Moving Ore by Scraping and Shaking

Use of Trench Scraping Spreads. An old practice like scraping might be expected to be static in respect to new developments. Nevertheless we note that trench scraping is now being done in Butte, both underground in stations and on the surface to eliminate ore bins.

Scraper mucking is being adopted for all straight sublevel drifts, not longer than 140 ft. by a big operator in the Canadian North. Time studies show that an 11½-hp. air slusher and a 30-in. scraper muck out a 5x7½ ft. drift faster than a loader with hand-tramming up to 70 ft. from the face.

A simple cat's paw device which permits scraper ropes to be attached more quickly, using a half hitch, has been adopted by **Mountain Copper Co.,** in California . . . At **Climax Molybdenum,** where 45 slushers are in operation, a rope can be changed in 15-20 minutes by two men, using a special car that has two outboard drums which reel in old cable or run out new. Each slusher uses 200-400 ft. of 1⅛-in. rope. Formerly this took five or six men 30 to 60 minutes. The center drum carries 600 ft. of ⅜-in. cable which pulls the slusher cable through the sheaves or the worn cable out.

Two companies are using the Pacific Round-The-Corner scraper, made by Alloy Steel & Metals Co., Los Angeles. This ranges in size from 26 in. to 60 in. and from 3 to 50 hp. One company is a **Southwestern copper company** which has purchased 13 Joy slusher hoists for these scrapers, to replace shakers. The other **(Eagle-Picher)** has found this scraper satisfactory in square-set stopes in its Arizona mines.

Shaker Conveyor for Iron Ore. To overcome the difficulty encountered in moving sticky iron ore in the conventional type of shaker conveyor trough, Goodman Manufacturing Co. designed a semi-circular type of trough mounted in a column-type of frame and supported by special inclined roller frame supports. The motion and speed of the drive were also changed to give a high-speed, heavy-kick motion. An installation made in an underground mine on the Mesabi Range is said to be moving the iron ore at a rate of 12 in. per stroke.

A 150-ft. conveyor has been installed at M. A. Hanna's Hiawatha mine between underground crusher and skip pocket. Bad ground made it inadvisable to have the dumping pocket and crusher at the station.

Belt Conveyor for Winter Stockpiling

Return Run Twisted To Keep Belt Clean. The first belt conveyor to be installed with a twisted return run is in service for stockpiling at Mather "B" shaft on the Marquette Range. (*E&MJ*, Dec., 1951). The belt is 36 in. wide and ried on a tubular-supported steel 655 ft. long c. to c. and is cartrestle. Two 180-deg. twists at the head and tail pulley-ends have proved their value in confining spillage to the two points of turning and at the tripper. Facilities for heating the gallery are provided. See p. 114.

In the Greater Butte Project, the skip pocket at Kelley Shaft and transfer bins will be linked by a conveyor line.

Record Lift Mine Conveyor. The vertical lift of the conveyor system to be installed in Dominion Steel & Coal Corp.'s Wabana mine in Newfoundland will be 1,733 ft. Co-designers are Goodyear and Stephens-Adamson. The system of 36-in. compass-rope belts, when completed, will be 12,500 ft. long, will have two flights 1,450 ft. long and eight flights 1,230 ft. long. It will handle 1,000 tph at 575 fpm. The vertical lift of the Chicago, Wilmington & Franklin Coal Co., conveyor, also Goodyear, is 868 ft. The latter has a 42-in. belt, 240 steel cables for the core, moves 1,200 tph at 615 fpm.

Pend Oreille Mines & Metals Co., Metaline Falls, Wash., has a two-lift conveyor system, the first lift being 1,450 ft. long with a 400-ft. lift and the second 1,200 ft. long with a 200-ft. lift. The first section will have cord belt, 30 in. wide. The conveyor will handle 350 tph.

The main-line belt conveyor haulage system installed in International Salt Co.'s mine in Detroit has replaced a system of mine cars, locomotives and trackage, all worn out. Conditions underground are conducive to long belt life. Mining height is 22 ft., making advance slow, thus favoring the use of conveyors.

Conveyors vs. Trolleys. A comparison of power requirements per ton of ore transported (*ME*, April, 1951, p. 340) by the belt and shaker conveyor system on one level of a Michigan iron mine with the requirements of the trolley haulage system on another level showed 0.42 kwh per ton for the 6-ton trolley locomotives and 5-ton mine cars against 0.12 kwh for the 36-in. belt conveyor.

For a new conveyor drive using an overhung driving pulley and costing much less to install than the customary drive. see p. 107. *E&MJ*, July, 1951. Likewise for a method of splicing steel cable belt.

see the same issue of *E&MJ*, p. 106.

New developments in conveyors to be used in connection with continuous mining are described briefly on p. 107 of *E&MJ*, July 1951.

The Barbecke iron mine in Germany is using a steel conveyor band 1,575 ft. long, 25.6 in. wide, and 0.8 to 1 mm. thick in a 10 deg. incline. It is driven by a 75-kw. motor. It replaces two rubber belt conveyors and two motors.

Shaft Sinking Today for Future Production

Sinking Technique Varied. Various large shaft-sinking jobs have had the spotlight turned on them recently, particularly at the recent Mining Congress meeting in Los Angeles. Grouting and concreting methods used in sinking New Jersey Zinc Co.'s shaft at Friedenburg, Pa.; the sinking of a new shaft by the freezing, method in the Carlsbad potash field; the sinking and concrete work done in the 38x9-ft. Kelley shaft of the Greater Butte Project; the sinking of two shafts on the San Manuel property in Arizona; and the technique developed for sinking two concrete-lined circular shafts in South Africa have all been described.

The chief feature of the method in South Africa is a double-deck sinking platform which can be moved up and down the shaft to set circular steel rings, guide the pouring of concrete, and facilitate performing of other necessary operations in the advancing shaft. Three successive world records were established this year in applying the method—described as continuous sinking and concreting—in the Virginia No. 3 shaft. These were 470 ft., 504 ft., and 389 ft. sunk and concrete-lined in March, April, and May, respectively.

Likewise from South Africa come the facts about a shaft-mucking grab which has a low-center of gravity, closes it jaws by air power, exerting full downward pressure on broken rock as the jaws close. See *E&MJ*, Dec. 1951, p.109. This grab is operated from a platform suspended below the bottom set. Two grabs will excavate a 5-ft. round, or 275 tons, in approximately four hours.

International Nickel's new No. 7 shaft at Creighton, 14 ft. x 110 in. in dimensions, is equipped with a parallel double-drum, geared hoist driven by two 2,750-hp. motors and handling 15-ton skips on flattened strand ropes. See *E&MJ*, Nov., 1951, pp. 96-98.

Mather "B" Shaft, on the Marquette range, managed by Cleveland-Cliffs, has a 100-ft. headframe instead of the 200-ft. structure which its twin "A" shaft requires —also a unique surface layout, all because of the unevenness of the ground at the shaft site originally. (*E&MJ*, Dec., 1951, pp. 82-86.) Turn sheaves are cseo to guide the rope and control the fleet angle.

The hydraulic ore hoist, or means for elevating ore hydraulically from underground to surface, developed by Percy S. Gardner, Jr., and being installed at Calumet & Hecla's Shullsburg, Wisc. zinc mine, is thought to have possibilities. See *E&MJ*, Jan., 1952, p. 94.

Some of the largest electrical hoist equipment in this country is being supplied to a Michigan mining company. The ore hoist will be driven by two 2,250-hp., 500-rpm, 750-v. dc motors, supported from a 3,500-kw. flywheel m-g set. The set consists of two 1,750-kw., 508-rpm, 750-volt, dc generators, a 210,000-hp.-seconds flywheel, and a 4,000-hp., wound-rotor induction motor.

The cage hoist will be driven by a 1,750-hp., 500-rpm, 750-volt, dc motor, supported from a 1,500-kw. synchronous m-g set. The generator runs at 514 rpm, and the synchronous motor is rated 2,100 hp., 80% pf, 4,160-v. Variable voltage controls, working through Regulex units, are being furnished for this equipment.

To increase hoisting capacity, **Combined Metals**, Utah, has installed a large service hoist in its main shaft, after shifting power cables to churn drill holes and pump lines into one large column in manway corner. . . . **Eagle-Picher** is currently installing small pneumatic rubber tires on cages in place of steel guide shoes. . . . **Wright-Hargreaves**, Ontario, has had success in use of hoisting rope made from electro-galvanized wires in upcast internal shaft, where the air is very corrosive. . . . **An Adirondack iron ore operator** is sinking a 9x12-ft. winze on 33 deg. with a three-drill jumbo and a scraper slide working on rails. Two men on drill shift and two on mucking shift complete a 7-ft. round per day.

Rock Bolting's Value for Ground Support

Use of Rock Pinning Spreading. Known variously as roof bolting or pinning, or rock bolting, the practice designated is being well studied. Over 50 noncoal mines using it are listed by the Bureau of Mines and there are many others. Bureau bulletins, a Mining Congress symposium, and magazine articles have viewed the subject from many angles. This is as it should be when a substitute such as rock bolting is proposed for long-used methods of ground support. Scattered comment following is a sample:

Tennessee Copper Co., Ducktown, finds that roof bolts and gunite do a good job in places of weakness. It has practically eliminated timber in haulage ways. . . . **Birmingham iron ore operator** has installed new roof-bolting carriages using air-driven crawlers with leveling platforms. A second company has a program for roof bolting and use of steel sets. . . . **M. A. Hanna** has decreased the amount of sloughing in certain areas at Iron River, Mich., by bolting several incompetent layers of shale together. . . . **At Howe Sound's Holden mine**, Washington, roof bolting and gunite reinforced with chicken wire are being used as ground support in slusher drifts—costs less, is quicker, provides more uniform job than old methods of concreting. . . . **Eagle-Picher** has tried roof bolting in one sheet-ground mine. To date it has shown no signs of failure. **Bunker Hill & Sullivan**, Idaho, uses roof bolting to a limited extent and is working with gunite in isolated places. **U. S. Smelting**, Utah, has been making tests since the fall of 1950. About 1,500 bolts have been installed in the Lark workings in that period. Some uses and some limitations have been established. . . . **Shenandoah-Dives**, Colorado, has bolts in the hanging wall, but a definite pattern has not been established.

Mines at Butte are using 3,000 to 4,000 rock bolts per month with consequent savings in cost. The central timber yard for all mines is in operation and construction of a packaging plant is to begin at once.

Hollinger Consolidated, Ontario, has used roof bolting to support ground in certain places. Practice appears satisfactory and will probably be extended.

Combined Metals, Utah, continues to use roof bolts in less faulted areas. Advantages are: The saving in cost of transporting timber underground and the cleared stoping areas which allow use of three-drum slushers instead of double-drum slushing through timbered areas. Company is also replacing timber in main shaft with steel sets. This will cut maintenance, also fire hazard.

A special stoper for rock bolting has been developed by Joy Mfg. Co.; also a complete rock-bolting unit comprising a self-propelled compressor in sizes up to 75 hp. and mounted on four rubber tires, with various hydraulic drill jibs on the same chassis of design

modified to suit conditions, and drills on the jibs. Joy has also a complete line of hydraulic roof-bolting drills.

LeRoi's Cleveland Division has introduced a crawler-mounted roof-bolting jumbo, mounting two stopers and designed for a complete bolting job in low headroom.

Comment on steel support runs: **Climax Molybdenum**, Colorado, is using steel sets on the lower Storke level. These appear satisfactory and decrease the amount of expensive excavation. The overall cost of drifts is decreasing by their use. . . . At a **New York State iron mine** all drifts are supported with 6-in. pipe caps on brackets and pins or posts with cedar lagging. . . . For **American Smelting and Refining Co.** steel shaft sets have become a better, faster way of shaft timbering at some of its Mexican properties.

M. A. Hanna has found steel sets satisfactory in a conveyor gallery at an Iron River, Mich., mine.

Miami Copper Co.'s circular steel sets cost $18.50 per foot, including the steel plus 29 bd. ft. of timber, plus $4 labor. Timbered drift costs $13.25 per ft. including 93 bd. ft. timber, plus $4 labor. The use of steel to date shows a normal saving in maintenance cost, also permits more continuous and uniform draw with less dilution.

Johnson's Co., Quebec, has abandoned steel sets in favor of concrete, placed by Rex Pumpcretes. All forms are steel section and movable on dollies of the company's design, capable of placing three sets, or 12 ft. of collapsible forms. Method is cheaper, faster, and the concrete is stronger than steel sets. Its use also improves ventilation. . . . **New Park, Utah**, concreted a new hoist room with a home-made concrete air-placement gun, saving many hours of labor.

More Attention for Operations Governing Work Conditions

Pumping and drainage data gleaned in this survey are all too scanty. Does this mean that mine pumping is not getting the attention it deserves? Many mine pumping installations have grown haphazardly.

A new automatic pumping system able to handle 14,000 gpm at 1000 ft. head has been installed by Chief Consolidated, in Utah. The 600-hp. 3,600 rpm centrifugal pumps that serve as boosters and the 450-ft. submersible pumps in the mine bottom are working well. New power lines and a new transformer station have been provided.

Acid mine water formerly compelled the replacement of iron pipe daily in the Knob Hill Mines, Wash. This difficulty has been met by using 4-in., 250-lb. Transite pipe with stainless fittings and a stainless Motorpump.

New high-pressure pumps have been installed by one of the four iron mining companies in the Birmingham district.

Automatic operation features a new pump station at the midway shaft station of Combined Metals, Utah. Work is being done on a new installation of deep-well pumps for the shaft bottom. This also will be designed for automatic operation.

No. 316 stainless steel centrifugal pumps were installed by a British Columbia gold company to handle acid mine water. They are also using 2-in. plastic pipe for drainage.

An electric deep-well pump has been installed by U. S. Smelting, Salt Lake City, for sinking a 25-deg. incline.

To increase pumping capacity and the margin of safety as and when needed, an Illinois fluorspar company has added a deep-well pump.

New self-sludging sumps installed by Roan Antelope are giving good results. See *E&MJ*, March, 1951, pp. 81-82.

Better Air for Rhokana Over 10 Years

Ventilation provided the field for one of the four major changes that were made in the operations of Rhokana Corp., Northern Rhodesia, in the 10-year period ended June 30, 1950 (according to E. K. McDermott, *Bull.*, I.M.M., Nov., 1951). It was improved greatly by mining permanent airways in the footwall quartzites, by more than doubling volume of air in circulation, and by providing a return airway on each grizzly or scraper level for removal of fumes produced by secondary blasting.

Artificial ventilation is getting increased attention from American Smelting & Refining Co., in Mexico, in an effort to eliminate dust-laden air as rapidly as possible.

Galvanized iron auxiliary ventilation piping is being used instead of flexible tubing by an Ontario base-metal company for increased life and lower costs.

A positive ventilation system for its Lark property is the objective of a ventilation program set up by U. S. Smelting. The program is to be completed this year.

Mechanical ventilation to reverse the natural winter ventilation, making the main haulage adit outcast, has been installed by Sidney Mining Co., Idaho. This has eliminated the bad icing conditions encountered in previous winters.

For removing gases and dust after blasting, **Hecla Mining Co.**, Idaho, has a "battleship" mine car which mounts an air turbine fan and three jets protected by V-shaped armor plate. The car is clamped to the rails 30-35 ft. back of the face. Air and water hoses are turned on before blasting. This stirs up the gases so that they can be picked up by a ventilation duct connected to the main fan.

Magma's new mine air-cooling system comprises a cooling tower and underground heat exchangers. Cold water from the tower is circulated through the exchangers in which high-pressure water from the tower takes up heat from water in a low-pressure circuit with low-pressure cooling coils.

More Light for Mining

To illuminate scraping operations, Sigma Mines, Quebec, has a Wolf Airturbo stope light, supplied in Canada through Climax Rock Drill Co. This has a single air-driven generator equipped with a sealed beam headlight. The bulb is 48-watt, approximately 6,000 cp, 6 v. Air consumption is 4½ to 6 cu.ft. per minute at 100 psi. The unit weighs 20 lb., is small and compact.

An Ontario base metal company has standardized on these lights. Their main use is to illuminate the slusher in mucking and filling cut-and-fill stopes. The area lighted is 15 ft. wide and 150 ft. long.

Negus Mines, at Yellowknife, N.W.T., is making greater use of 110 v. lighting in stopes, particularly when scraping . . . Asarco is getting better lighting through greater use of storage battery lamps.

Maintenance Aids

For Welding. General Electric's Carboloy Department has developed two rods, one of cemented tungsten carbide and the other of chrome carbide containing 70% chromium, with no cobalt or tungsten. The latter is said to be as hard as tungsten carbide and to wear better, to resist heat better than stainless steel or tungsten carbide, to resist oxidation up to 1832 deg. F., and to have 30 times the resistance of stainless steel to corrosion by sulphuric acid.

Part 2 of this article, covering surface mining practice, will appear in an early issue.

FIRST HMS PLANT on Marquette Range, this Cleveland Cliffs HMS-spirals plant typifies growth of iron ore treatment. Wemco-WKE designed and built it. Cleveland Cliffs also plans Iron Country's first flotation plant.

Taconite Plants, New Processes Come First in Iron Ore Plans

L. A. ROE,
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Madison, Wis.

RESEARCH AND DEVELOPMENT programs for beneficiating iron ore by flotation, magnetic separation, gravity concentration, Heavy-Media Separation, plus new ideas for metallurgical treatment of iron ores, made the ferrous end of the milling field a lively place last year.

Full-scale taconite treatment was on its way to reality in 1951, with the start of construction of several plants. The largest is the Beaver Bay plant of Reserve Mining Co., which will process 7½-million tons of magnetic taconite per year. Finished product will be 2½-million tons of 64% iron pellets yearly. Contracts amounting to $75-million have been let, and initial production is expected within five years. Reserve is owned by Armco Steel Corp. and Republic Steel Corp.

Perhaps the biggest news this past year in the iron ore industry was the announcement late in November that Cleveland Cliffs and the Ford Motor Co. plan to build a commercial iron ore flotation plant at the old Humboldt Mine in western Marquette County in upper Michigan. It will be the first such plant in the Lake Superior region. No doubt the experience gained at this Humboldt plant will aid in design of several flotation plants that other iron ore producers are now planning. Success at Humboldt would also hasten development of taconite flotation.

Gravity Separation

Heavy-Media Separation plants continue to increase in number and size in both the Lake Superior and the northern Alabama districts. The latter region can report a 100% increase in the number of HMS plants during the past year. The aggregate production of the Alabama plants now exceeds 1-million tons of concentrate per year. With feed rates of 80 to 120 tons per hour, the Alabama plants report costs of 35 to 45¢ per ton of concentrate produced.[1] Medium losses average about 1 lb. of ferrosilicon per ton of separator feed. This is less than the average consumption reported from the Mesabi Range. Several new HMS plants are planned in Alabama.

Studies of middlings control in HMS plants are under way in several plants. Continued development of more efficient separatory vessels should result in advancements in this phase of HMS practice. The economy of lower gravity is becoming evident in some Mesabi plants. The presence of large quantities of "paint rock" or limonitic material in plant feeds often forces operators to drop the gravity of their medium from the usual 3.1 to as low as 2.65 for short periods. One operator reports that he has encountered conditions in his plant where medium with a gravity of 3.10 would support a large iron bolt.

Jigs are being installed in more HMS plants to handle the finer sizes. Another eastern magnetite producer is using jigs to remove a coarse concentrate from a magnetic separator rougher product. The new Tyler repulping screen is being used at the Algoma Steel HMS plant in Canada. Benson Mines is also using them in a new spiral plant. Recent success in use of the Dutch State Mines Cyclone on minus ¼-in. ores may slow down the trend to jigs for the finer-sized fractions.

During the 1951 operating season, a well-worn path was beaten to

[1] In *E&MJ* for July, 1951, p. 132, it was reported that "a fair-sized Iron Country HMS plant cost 22¢ per long ton of feed," including power, labor, maintenance, and medium. This should have read "per long ton of concentrate."

the Buckeye plant of the M. A. Hanna Co. on the western Mesabi Range. The main attraction was the new full-scale cyclone plant that replaces the test plant run there the past two seasons.

The cyclone plant handles ores too fine for conventional Heavy-Media processing. Results of the full-scale plant substantiate the test results reported in *E&MJ* for June, 1950, by Erickson and Herkenhoff.

In the Buckeye plant, a conventional HMS plant handles 250 tons per hour of plus ¼-in. feed. The cyclone plant, consisting of only two 12-in. cyclones, handles 125 tons per hour of minus ¼-in., plus 65-mesh material. Feed contains 11 to 13% moisture.

Residence time of a given particle in the cyclone is measured in fractions of a second, and up to 5 tons of the magnetic medium is circulated with each ton of feed to the cyclone. Note that the cyclone plant uses magnetite medium instead of the ferrosilicon used in the other section of the Buckeye plant. Loss of magnetite medium in the cyclone plant is slightly higher per ton of feed than loss of ferrosilicon in the standard plant. The cost-per-ton of feed is lower for magnetite, however, because of its lower first cost.

Wear of cyclone parts is negligible. The bottom orifice has to be replaced once a week, but the cost is insignificant. Manpower requirements in the plant are low and plant operating efficiency is high. No trouble is experienced in cleaning medium by magnetic separation, except when treating certain ores that carry considerable magnetite. At such times, there is some buildup of medium that has to be handled in the reclamation circuit.

Spirals

Several new Humphreys spiral plants have appeared on the scene in 1951; also, some of the older plants were increased in size. The Patrick-Kevin plant in Minnesota was awarded orchids by several observers for its clean-cut design and some innovations for spiral plants. The feeding system is noteworthy and insures a uniform feed to the plant. A diaphragm pump is used to meter feed to the spirals, and an improved feed header is used on each spiral.

The battle of abrasion continues in the spiral plants. In some Mesabi plants deep channels have been worn completely through the spirals in less than three operating seasons or about 18 months. Other plants handling more abrasive ores do not expect cast iron spirals to last over one year. A number of plants are attacking the problem energetically and have under test rubber-lined spirals, spirals with special metallized surfaces formed by metal spraying, ceramic-coated spirals, and spirals made completely from Ni-Hard. The ceramic linings have a good chance of success since similar problems have been solved by application of this material. Porcelain enamel-coated coal, grain, and coke chutes have been in use for years and have proved even more effective than rubber-lined chutes. The cost of enameling a spiral will be less than one-third the cost of a cast iron replacement spiral.

Magnetic Separation

The patent literature shows that interest is running high in the development of separators which will economically produce a true middling product. Recent patents of interest in this respect are 2,558,635 to D. N. Vedensky and L. J. Bechaud; 2,559,565 to R. E. Crockett and P. S. Haselton; and 2,560,809 to H. K. Martin.

Automatic analyzers for continuous recording of losses of magnetics from separators are under development. These will be useful tools in magnetite plants as well as in HMS and cyclone plants.

Another fact becoming evident in the field of magnetic separation is that it is difficult to design one universal separator which can be used on eastern magnetites, on Mesabi taconites, and for cleaning of ferrosilicon in HMS plants. When and if magnetic roasting of iron ores is practiced on a commercial scale, it will also become evident that synthetic magnetite and gamma hematite (both are magnetic) behave somewhat differently in a magnetic separator than natural magnetites.

The new Cleveland Cliffs-Ford flotation plant at the Humboldt mine should begin production by late 1953. The first unit will have a capacity of 200,000 tons of concentrate annually. A second similar unit should be in operation by 1955.

Feed will be a hematitic jasper, but it hasn't been announced whether the iron will be floated away from the jasper or vice versa. Best guess is that the iron mineral will be floated, because the Humboldt ore contains much specular hematite, which is easily floated and can be cleaned to produce a high grade concentrate.

R. J. Morton, of Oliver Iron Mining Co., has a patent (No. 2,551,893) on use of portland cement as a reagent in flotation of iron ores. Work sponsored at Battelle by iron ore producers sometime ago has resulted in a patent (No. 2,557,361) to W. C. Hazen on use of ion exchangers in iron ore pulps.

Armour & Co. has a fellowship waiting at the University of Minnesota for someone interested in getting to the bottom of the slime problem in iron ore flotation.

Research in colleges, private institutions, and in federal and state laboratories continues unabated. A 1951 review of current research published by the Engineering College Research Council of the American Society for Engineering Education lists no less than 30 projects on iron-ore beneficiation. In contrast, only 13 are listed for the ores of copper, gold, antimony, manganese, zinc, lead, and nickel combined. It is estimated that private industry is now spending at least $1-million per year for more-or-less fundamental research on iron ore beneficiation. The cost of studies in the pilot plant stage is more difficult to determine, but will involve several million dollars more. Iron ore research and testing is now big business.

One large producer has initiated research on the instrumentation and automatic control of iron-ore beneficiation plants. This project should produce real results in short order. The instrument companies are all showing much interest in the taconite program and are going all out to help develop new instruments for use in iron ore plants.

Agglomeration

Interest in new and improved methods of agglomerating iron ores continued on a high plane the past year and will not slow down in the foreseeable future. Pelletizing is still commanding most interest on the taconite front. Publicity on the pelletizing process is even reaching the popular press. *Popular Mechanic's* lead article in its December issue was titled, "Taconite Is Tomorrow's Iron." For some descriptions of ore-dressing equipment in the popular vein, the article is recommended reading for you millmen. In the technical press, *Chem-*

ical Engineering carried a feature report on "Agglomeration" in the October, 1951, issue. The article covers both pelletizing and sintering of iron ores and contains much information on the fundamentals of pelletizing.

A progress report on the pelletizing of magnetic taconite concentrates was given by E. W. Davis and H. H. Wade in the July 30 issue of *Steel*. Wet and dry strength tests on balls made from magnetite ores are given. Typical balls analyze from 1.09 to 1.20% carbon. Discharge of large masses of fused pellets is still a problem in the larger furnaces. Several blast furnace trials were run on pellets during the past year.

Sintering

Sinter plant capacity continued to expand during the past year. Jones and Laughlin Ore Co. broke ground on a new $2-million sinter plant addition at its Benson Mine plant in upstate New York. This new installation will contain many new features to improve plant control and result in all-around better performance. The two existing sinter machines at Benson have been modified during the past year. One change giving good results is the substitution of drum-type feeders for swinging spout feeders.

The world's largest sintering machine was installed at the Blackwell, Okla., plant of the American Metal Co. for sintering sulphide ores. The moving grate is 12 ft. wide and 168 ft. long. The machine provides a hearth area of 2,016 sq. ft., which is about 3½ times that of a 6-ft. machine. This giant will be closely watched by the iron ore industry.

Greater use of instrumentation is evident in all the newer sinter plants. As expressed by a British sinter expert, "There are perhaps even more variables in sinter-making than in iron-making." More instrumentation is needed to first study these variables and later to control them. Automatic control of moisture in the sinter mix has long been a dream of the sinter plant operator. Improved instruments may soon make this a reality. At present the most useful moisture tester on the market is one which operates on the pressure derived from the wetting of a measured amount of calcium carbide by a measured amount of ore in a closed container. Moisture contents are read directly in percent on a dial-type gauge. This tester is widely used in foreign sinter plants and in some U. S. plants. One British plant is using electrically operated remote-controlled valves on the water lines to the mixers for improved moisture control.

Some conversion costs for sinter were published by a reputable author during the past year. In considering one pan or Greenawalt plant and three pallet or Dwight-Lloyd type plants, the cost ranged from 95¢ to $1.95 per ton. Most plants that keep accurate cost figures have reported costs in this range, but by far most of them are on the higher end of the scale.

Oliver Iron Mining Co. is now in the midst of full-scale tests with its Virginia, Minn., sintering plant. Outcome of the nodulizing kiln tests are awaited with interest in many quarters. Previous nodulizing experience in this country during World War II showed that sintering costs were 40 to 60% less than nodulizing for a given ore. However, the new Minnesota plant has a much larger kiln and the latest in auxiliary equipment. This may bring nodulizing costs down considerably. A small 4-ft. x 57-ft. nodulizing kiln was used in a pilot plant test near Tokyo, Japan, to process a limonite ore. No difficulty was experienced with rings. They are now building two new kilns, each 125-ft. long with 6-ft. id. Expected capacity of the new kilns will be 100 tons per 24 hours. Nodules produced are about ¾-in. dia.

The current scramble for more open-hearth charge ore has pushed a new company into the agglomeration picture. This is the Blocked Iron Corp. The process used is carried out in cement-block plants using conventional cement-block production equipment with the exception that cylindrical molds are substituted for the cement-block molds. The ore fines are mixed with calcium chloride, portland cement, a chemical binder and water. The blocks are compacted in the molds and then steam-cured for 12 hours, as are cement blocks. The finished 25-lb. blocks produced supplement the charge ore for open-hearth use. Eight plants are now in operation, four of them being located in the Gary, Ind., area.

Sponge Iron

Sponge iron received considerable attention in 1951. P. E. Cavanagh reported on a Canadian pilot plant operation on Steep Rock ore. Costs for 90% reduced iron were estimated at $42.75 per ton sponge iron at a production rate of 6500 tons per year.

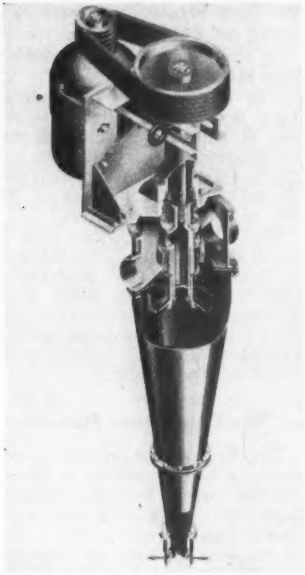
The Venezuelan Development Corp. is conducting research on the use of natural gas for reduction of Venezuelan ores. If tests are successful a 2-million ton plant will be built near the junction of the Caroni and Orinoco rivers.

The Hoeganaes Sponge Iron & Metal Powder Corp., affiliated with a Swedish firm, is progressing rapidly on its new plant near Riverton, N. J. This operation will reduce iron ore into metal powder and then fabricate various products from the powder.

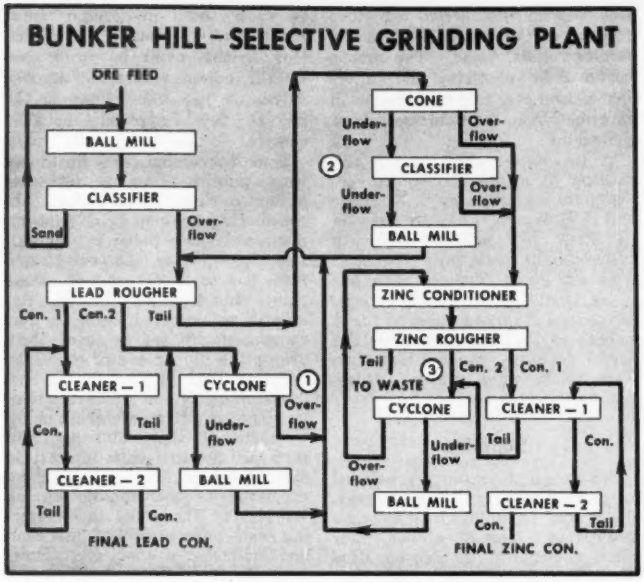
The Krupp-Renn Process

The Krupp-Renn process has received a lot of publicity in recent months. Several iron ore producers have been quietly investigating the process for several years. The Krupp-Renn process of iron ore beneficiation was developed by the German Krupp Co. during the early nineteen-thirties. In this process a mixture of low-grade ore and coke is processed in a rotary kiln at high temperature. The metal in the ore is reduced by solid carbon and the metallic particles fuse together to form small iron pellets, known as "Luppen." The metal never becomes completely molten and is recovered in solid form. As discharged from the kiln, the metallic iron is dispersed as rounded granules in a pasty, glassy slag. The iron pellets are prevented from re-oxidizing by this slag coating. The slag mass is crushed and the iron recovered by magnetic separators. Detailed reports of Krupp-Renn tests in Czechoslovakia have appeared in several publications. The feed used was a French ore containing 34% iron, 25% silica, and 3% calcium oxide. A kiln 197 ft. long and 11 ft. 10 in. in dia. had a capacity of over 72 metric tons of finished product per day.

One Krupp-Renn plant is operating in Japan at the present time. The Dominion Iron & Steel Corp. Ltd. is planning a plant in the eastern Transvaal district of South Africa. Cost of a plant in the U. S. have been estimated to range from $16 to $25 per annual ton of concentrate capacity or about the same as for a magnetic taconite plant. As our iron ore program moves ahead, we can expect more thorough investigations in various laboratories along the line of the Krupp-Renn process.



NEW TYPE of cyclone aims at combining cyclone and centrifuge. It's called Centriclone.



NEW USES for cyclones are illustrated by Bunker Hill's selective grinding flowsheet. No. 1 is a Centriclone making a sand-slime separation on lead products. No. 3 is a DorrClone doing same job on zinc products. No. 2 an esperanza.

Cyclones Set Pace In Milling

Industry discovers usefulness of cyclone in desliming and other classification jobs. Rod milling seen as two-stage job. Starch finds new uses in flotation.

PROBABLY THE MOST SIGNIFICANT event for nonferrous mineral dressing last year didn't take place in that field at all. It occurred in the field of iron ore beneficiation, where research has mushroomed in a million-dollar growth that far overshadows research programs in the nonferrous field.

Note in Mr. Roe's review of iron ore beneficiation in this issue the comparison between the scale of research in the two fields. Note also that Iron Country metallurgists are planning to leap in one bound from the relative simplicities of log washers and screening plants to complex, instrument-controlled jobs involving the whole gamut of mineral dressing operations. It's an exciting time for them.

This is not to say that nothing is happening in the nonferrous field. New hydrometallurgical processes are coming along fast, and there is progress toward a better understanding of grinding and of the mechanics of the flotation machine. The use of cyclones for desliming and other classification jobs is spreading rapidly. And of course this last year saw an unusual number of new mills planned or started.

The increased attention to hydrometallurgical methods, noted in this section last year, makes the nonferrous field even more interesting. Most of the copper companies are leaching ore once more, in one way or another, and leaching-in-place may turn up one of these days in a place where you'd never expect it.

By far the most interesting of current hydrometallurgical developments (only hinted at last year) are the new plants that will use the leaching-precipitation techniques developed by Chemical Construction Corp. and its associates, including Sherritt-Gordon, Howe Sound, and National Lead.

It is reported, for example, that satisfactory pilot plant results have been obtained in Sherritt-Gordon's ammonia leaching plant for treating sulphide copper-nickel-cobalt concentrates from its new Lynn Lake mine in Manitoba. Using a variation of the Chemico method, Sherritt will operate a plant near Edmonton that will have a capacity of 8,500 tons of nickel, 300,000 lb. of cobalt, and 4,000 tons of copper annually. Copper will be produced as a sulphide; the other two metals will be produced as pure metal powders.

Howe Sound's subsidiary, Calera Mining Co., is building a plant to use Chemico's acid-leaching technique for producing cobalt and copper as pure metal powders. This plant, which should begin operation early in 1952, will inevitably be regarded by many as a pilot plant for eventual large-scale copper operations, if technical and economic problems can be solved.

Classification

Greatest growth of the year was undoubtedly in the use of cyclones for classification and thickening. DorrClones, Centriclones, and just plain cyclones have turned up in plant after plant. The following paragraphs don't attempt to list all the installations. There are simply too many of them, and they bear witness to how rapidly a good idea will take hold, particularly if by "good" you mean simple, effective, and comparatively inexpensive.

In size these units range from ten 4-ft. cyclones desliming about 400 cu. yd. an hour of phosphate rock down in Florida, to a small 6-in. cyclone that deslimes classifier overflow in a gold mill. Here are some examples:

A New Mexican lead-zinc mill is installing a 10-in. Centriclone (See *E&MJ*, Jan. 1952, p. 122) to replace a 20-ft. thickener that has been preparing feed for a regrind mill. Tonnage of middlings to be reground is low and variable, and the management felt that the time lost in the thickener affected later flotation adversely. Also, the need for building up a circulating load with the thickener made it impossible to run the regrind circuit on intermittent schedule. The Centriclone seems likely to solve these problems.

In a northeastern lead-zinc mill, which increased its capacity by 50% this last year, use of the DorrClones made it possible to handle the increased load of pyrite concentrate without putting in more filters. Two DorrClones in series thicken the filter feed to the point where a greater tonnage is handled with fewer filters than were formerly needed.

Magma Copper Co., according to Halder Rex, mill superintendent, is replacing its 7x30-ft. Esperanza-type drag classifier in the regrind section of the mill with a 15-in. cyclone. The results are comparable and the cyclone is considerably more flexible in operation.

In the flowsheet shown above, covering Bunker Hill's selective grind for lead-zinc flotation, note that both a DorrClone and a Centriclone are used. The latter was brought out this last year by Kellogg Krebs, following a long period of field and laboratory tests. It makes use of an impeller in addition to the centrifugal force of the whirling pulp. Full details will be published in a forthcoming issue.

The DorrClone is the development of the Dutch State Mines cyclone as applied to thickening and classification. The American Cyanamid Co. handles use of the cyclone for actual concentration of minerals by means of a heavy medium in the cyclone.

The DorrClone is being used for all sorts of desliming jobs; for example, it has become commonplace to see DorrClones thickening mill tailings, either for stacking, pumping, or running back into the mine for fill. As was indicated by the Magma experience mentioned previously, cyclones, used intelligently, offer definite advantages for certain jobs.

The DorrClone is also offered with an automatic control device that keeps underflow density nearly uniform regardless of changes in density of feed.

Grinding

Any discussion of grinding these days is bound to bring in the question of what to do with a rod mill. One point of view is exemplified by the huge 11½x12-ft. rod mill now running at Consolidated Mining & Smelting Co.'s mill at Chapman Camp, B. C.

Described by H. R. Banks, mill superintendent, in a paper at the last CIMM meeting, this mill uses lifter bars 3¼-in. high, 3½-in. rods, and a shell speed of 670 fpm (18 rpm, 80% of critical). It crushed about 7,500 tons daily of 1½-in. feed to 90% minus 6 mesh. It is followed by three stages of ball mill grinding.

A quite different set of conditions obtains in the rod mills run in the Hayden concentrator of Kennecott Copper Co. down in Arizona. Developed under the direction of Walter I. Garms, the Hayden technique employs a 9x12-ft. rod mill run at 14 rpm, a shell speed of 396 fpm. Lifter bars are 1¾ in. high; rods are 3-in. Feed is ⅜-in.; discharge is minus 10 mesh.

Jack Myers, who generated the present interest in fine crushing with rod mills, points out these facts in a discussion of the Banks' paper. Jack presents strong arguments for the concept that the Banks rod mill is basically a coarse crushing mechanism, and that the Garms mill is a fine crushing mechanism that also provides a certain amount of classification through the rod interstices.

In watching the big rod mill running at Chapman Camp, Jack was tremendously impressed by the powerful impact delivered to the ore particles by the high lifter bars smashing at high speed into the rod load. In fact, as Jack mentioned in his discussion, the mill's coned ends are necessary in at least one respect, in that they permit easy discharge of the rods that are broken by the hammering of the mill. He saw rods as large as 2-in. in diameter broken into pieces as long as 4 ft.

Jack did not present his discussion as an attempt to rate one concept as better than the other. His point is that rod mill crushing is a two-stage affair. In support of that belief, he is converting the mills at Copperhill, Tenn., to use two-stage rod milling.

Tennessee Copper's present flowsheet reduces 2,200 tons daily from ½-in. to 52.5% minus 200 mesh in a 6x12-ft. rod mill and a huge Tricone ball mill. The new flowsheet is planned to reduce 2,300 tons daily of ¾-in. feed to 56% minus 200 mesh in a 6x6 or 7x7-ft. rod mill, a 6x12-ft. rod mill, and the Tricone. These two rod mills will be run in accordance with the concepts of Messrs. Banks and Garms, respectively.

Having in mind the fact that the high-speed rod mill can crack rods as well as rocks, it would be interesting to work out a comparison of the overall consumption of power and steel per ton ground, and power per ton of steel consumed, in the whole crushing operation from ¾-in. to 10 mesh, using the several flowsheets that are available.

No Overgrinding

Jack Myers brings up another point for discussion that ought to start a lot of it. He suggests that there is no such thing as overgrinding of mineral particles, in the sense that they can become too fine to be floated. He does agree that extended grinding can affect subsequent flotation adversely, but he suggests that this is due to increased opportunity for chemical reactions to affect the floatability of ore particles.

Certainly results have been improved at a great many plants by holding grinding of soft ore minerals to a minimum. It would help, of course, to know if the improvement was due simply to an avoidance of sliming or to inhibition of surface reactions.

The flowsheet shown at the beginning of the article illustrates the practice at one such plant. Bunker Hill's selective grind, worked out largely by Frank McKinley, formerly assistant mill superintendent, is aimed at grinding

to varying degrees of fineness the several portions of the ore according to their need of grinding. Particularly, the flowsheet is designed to avoid grinding barren particles beyond the size necessary to let them get through the mill, to avoid grinding the galena too fine, and to grind fine enough to liberate the sphalerite.

The flowsheet shows how the lead rougher circuit is closed with a sand-grinding circuit, and that several products are classified and the coarse portions are ground. A DorrClone and a Centriclone have proved very well suited to this sand-slime separation.

As a result of using this flowsheet, Bunker Hill reports lower grinding costs, increased recovery of lead, silver, and zinc, improved grade of concentrate. The flotation pulps are run at a higher density and at a higher temperature, both beneficial.

The question of slime coatings brings up Wemco's new attrition machine, a multi-cell device resembling a flotation machine in which impellers direct streams of pulp against each other to gain maximum attrition with minimum wear of equipment. Details are on p. 147 of this issue.

Rubber-lined ball mills, which were tried and abandoned many years ago by Homestake Mining Co., may be back in the picture. Linatex Corporation of America, a company formed to sell this British product in the U. S., intends to try Linatex for lining mills. The company is located at Rockville, Conn.

Flotation

New flotation machines are under development down in Florida, at Tennessee Copper and elsewhere. It looks as if a serious effort is being made at last to find out what a flotation machine ought to do and how best it can be done.

The Mexico City meeting of the AIME was highlighted by reports of the excellent work done in Mexico in separating lead, copper, and zinc sulphides by use of sulphur dioxide and starch as flotation reagents. Starch seems to have been overlooked elsewhere, except in nonmetallic flotation, and there are a number of investigations under way as a result of that Mexico meeting.

From Noranda, H. L. Ames, concentrator superintendent, reports that a water-lubricated bearing of Gatke bushing material, developed at Noranda, seems to have eliminated one of the last troublesome features of the MacIntosh cells used there. The bearing supports the cell's rotor and admits air through the hollow shaft.

The bearing is centrally placed between the packings in a bearing box attached to the flotation cell. An air box, recessed for packing, floats on the shaft end. A slight waste lantern ring, also of Gatke bushing material, is located between the bearing box and air box. All are held in place with gland studs extending from the bearing box to the air box flange. Tightening the gland stud nuts forces the ring into the packing recesses of both boxes. This is adjusted until only a few drops of bearing lubricating water a minute escape along the rotating shaft and through the holes in the exposed lantern ring.

The original Gatke-type bearings were installed 2½ years ago and give good service with little attention. The further improvement of the sight waste lantern ring makes it easy for the operator to check the tightness of the bearing.

Stibnite Floated

From Stibnite, Idaho, J. S. Anderson, mill superintendent at the Yellow Pine mine, reports an interesting development of differential flotation of stibnite and pyrite. For six years, Yellow Pine made a bulk float of stibnite and gold-bearing pyrite and arsenopyrite, thereafter floating the latter away from the stibnite. In November of last year, ore began coming in that contained some kind of antimony-arsenic mineral that made it impossible to continue this treatment.

Late in December the mill was converted to float the iron sulphides first and then the stibnite. Selectivity is based on pH. The iron and arsenopyrite float at about 11; then sulphuric acid is added to drop the pH to about 7.5, whereupon stibnite floats. There is some loss in recovery, but the antimony concentrate is again low enough in arsenic so that the smelter will accept it.

At the Eagle-Picher Central Mill, in the Tri-State, Ed Crabtree reports that a flotation machine was installed last year ahead of the conventional lead-zinc circuits. Using an alcohol frother (methylisobutylcarbinol) as the only reagent, this machine floats off an asphaltic residue occurring naturally in the ore. The result has been improved grade and recovery for both lead and zinc.

One mill reports that use of Reagent Z-105, a Dow Chemical product, as a collector in the zinc circuit has improved rejection of pyrite and insol.

Humphreys spirals, referred to at greater length in the iron ore review, are now recovering the following minerals: ilmenite, rutile, zircon, magnetite, hematite, chromite, scheelite, hubnerite, wolframite, cassiterite, pyrite, barite, galena, sphalerite, monazite, pebble phosphate, flake mica, anthracite coal.

Aside from new plants in the iron ore field, spiral plants were set up this last year to treat chromite ores in New Caledonia and in the Philippines. Smaller plants were set up to handle barite, cassiterite, and monazite.

In the field of dense media separation, most of the developments have taken place in treating iron ore. However, it is interesting to note that at least one company has found it profitable to use Heavy Media Separation to remove undesirable constituents from gravel to be used as concrete aggregate.

Combined Metals Reduction Co. is using a small sink-float plant ahead of its primary grinding circuit in order to increase plant capacity. Other lead-zinc mills are known to be thinking of doing the same.

Long-Line Pumping

International Nickel Co. probably has set some kind of a record with its new concentrate and tailings pipe line between Creighton and Copper Cliff. Bulk flotation concentrate (nickel-copper) produced at Creighton is pumped 7½ mi. to Copper Cliff. Tailings from both Creighton and Copper Cliff pass through the pipe lines and are discharged at a disposal point midway between. The line uses about 40 mi. of wooden pipe.

The pipe lines carry about 2,500 gpm of tailings and 800 gpm of concentrate, a load of 8,200 and 1,800 tons respectively. The line has five relay pump stations.

Calera Mining Co., the Howe Sound cobalt subsidiary, also has an interesting tailings-pumping job. Head on, the pipe line from the plant to the "top" of the mine, is 760 ft. Each of the five pump stations includes two Frame B. Hydroseal pumps connected through valves to the 6-in. wood stave line. Total length of the line is 6,300 ft. A 24-in. DorrClone thickens the tailings to 45% solids for pumping. At the end of the line, two more DorrClones thicken the pulp to 66% solids for use as mine filling.

In Nonferrous Metallurgy . . .

- **Nickel, cobalt: A new leaching technique stole the show.**
- **Zinc: A new electrothermic process threatens electrolysis.**
- **Titanium: For this exciting new metal, a host of companies are competing to develop the best production technique.**

A. W. SCHLECHTEN, Professor of Metallurgical Engineering, Missouri School of Mines and Metallurgy

A SURVEY OF THE PAST YEAR gives the impression of frantic activity to increase the production of all metals. Plant expansions and new projects are springing up in every direction. All of them are handicapped from the very beginning by shortages, delays, and changes of plan. One of the worst shortages is that of trained metallurgical engineers; it is one shortage that cannot be cured by plant expansion.

We can only hope that the new plants are all based on sound engineering and that they will not turn out to be war babies built with a "hang-the-expense" philosophy. One also wonders whether the new installations will incorporate processes and equipment that represent true progress in metallurgy.

Everyone seems to realize by now the importance of research and the necessity of striving constantly for improvement in methods and equipment. The navy, the army, the air force, and other sub-divisions of the military have poured millions of dollars into research. We have read innumerable papers on alloy investigations—the properties, the structures, and the uses—all sponsored by government grants. But where are the investigations on copper smelting, lead refining, zinc retorting and the like? Certainly, this phase of metallurgy could also profit from intensive research. We must remember that the chief requirement for making rabbit stew is to catch a rabbit, and the chief requirement for an alloy is to get some metal.

The separation of nickel and copper by selective crystallization of the sulphides in the matte is now an established procedure of the International Nickel Co. A recent German article by H. Schlecht and L. Schlecht describes how they heated a nickel-copper matte at 700°C. for 24 hours and grew Cu_2S crystals in a mass of Ni_3S_2. They report regretfully that INCO discovered the same thing independently and patented it. We might point out that Professor C. R. Hayward reported similar experiments over 30 years ago in Volume 48 of the "Transactions of the AIME," but at that time he had no way to separate the two sulfides which have about the same specific gravity.

Leach Yields Metal Powders

One interesting development, that has grown from laboratory research through pilot-plant testing and is now ready for full-scale use, is the new process to be used by Sherritt-Gordon for the treatment of nickel concentrate (which also contains cobalt and copper). This involves an ammonia - oxidizing leach of the raw concentrate with subsequent treatment of the leach liquors to yield the nickel and cobalt in the form of metal powders. The sulphur recovery in the form of ammonium sulphate will be about 75%. The original research was described by Forward, Samis, and Kudryk in 1948, but at that time they roasted the concentrate before leaching. Evidently subsequent work has shown that leaching under pressure will effectively decompose the raw sulphides. The plant, which will treat concentrate from the new Lynn Lake property, will be built in Alberta to utilize natural gas in the manufacture of the required ammonia. It will have an estimated annual capacity of 8,500 tons of nickel and 300,000 lb. of cobalt.

The new cobalt refinery of the Howe Sound Co. at Garfield, Utah, is expected to produce in the neighborhood of 2-million lb. of cobalt a year. The ore from the Blackbird mine near Salmon, Idaho, is being concentrated by flotation and at Garfield the cobalt will be leached and deposited electrolytically.

The nickel and cobalt scarcity has intensified interest in working out a process for the treatment of residual iron concentrate from the Fredericktown, Mo., property of the St. Louis Smelting and Refining Co. It is known that the Bureau of Mines has worked on this problem, and it has also been studied on a pilot-plant scale by the Chemical Construction Co. News releases state that a $5-million plant will be built.

Copper production will be increased by expansion at such established plants as Kennecott at McGill and Ray, Phelps-Dodge at Bisbee, and Anaconda at Butte. The most startling news is that $57-million will be loaned by the RFC to the White Pine Copper Co. to develop its holdings in upper Michigan.

Several recent papers describe studies of certain phases of copper smelting. F. E. Lathe writing in the *Canadian Mining and Metallurgical Bulletin* outlines the effect of alumina in slags. His review, based mainly on phase diagrams, shows that alumina added to the FeO-SiO_2 system lowers the melting point. This is true whether the Al_2O_3 is substituted as an acid or base; the replacement of Al_2O_3 for FeO has the added advantage of reducing the specific gravity of the slag. Mr. Lathe states that alumina added to a pyritic smelting charge at Kalata Consolidated increased the slag fluidity and lowered the copper losses. However, an investigation by Scobie showed no consistent relation between copper losses and alumina additions. It is pointed out that attack on refractories must be considered; in this connection it has been said that the reverberatory life at Hayden was greatly increased by severely limiting the Al_2O_3 content of the charge.

Reverberatory operation at Noranda during the past year has been aimed toward greater efficiency with respect to fuel and labor. During the first nine months of 1951 the fuel ratio was 2.57-million Btu

per ton of solid charge on an average of 1,350 tons of solid charge per furnace day; this is the lowest fuel ratio ever obtained at Noranda over such a period. New waste-heat boilers are being installed which have the following principles of design: First, there are no baffles and the gas flow is horizontal at low velocity to minimize the sand-blasting effect of dust on boiler tubes; second, a simplified arrangement of tubes and drums facilitates repairs; and third, improved soot blowing eliminates the necessity of hand-lancing.

Noranda is also continuing with the use of weighing flux feeders, operation timers, and flowmeters on their converters as a means of improving and controlling operation. They feel that with these devices a converter can be operated without the services of an experienced practical converter man.

Schuhmann and his associates at MIT have recently published two papers, one dealing with the activity of sulphur in liquid copper sulphides and the other on the thermodynamics of iron-silicate slags. These are a part of a fundamental study on copper smelting and may be compared to the investigations on the physical chemistry of the open hearth, many of which are presented in the second edition of "Basic Open Hearth Steelmaking" just published by the AIME. Incidentally, this book should be of interest to nonferrous metallurgists.

Roaster Aids Hydrometallurgy

The increasing interest in hydrometallurgy has been pointed out by R. H. Ramsey writing in *E&MJ* and the various applications are outlined by N. Arbiter and H. H. Kellogg in an article in the July, 1951, issue. In addition to pressure leaching as planned for the Sheritt-Gordon plant, there is great promise for orthodox leaching on calcines from fluo-solid roasting. The close control of sulphur elimination and sulphate formation with this system should make it attractive for many applications. A good description of the fluo-solid roaster at Campbell Red Lake Mines has been published during the past year. The feed is added as a slurry with 70 to 80% solids and the temperature of roasting can be controlled within a variation of 40°F. over a range anywhere from 900 to 1700°F. The roaster unit, operated by one man, will handle 75 tons of charge per day and gives a calcine of 0.08% sulphur from a feed running 23.8% sulphur. It is understood that the New Jersey Zinc Co. also has a fluid-bed roasting method of its own under consideration.

Zinc—Sterling Process

The constant competition between pyrometallurgy and hydrometallurgy is reflected in the statement that Cerro de Pasco will postpone the proposed expansion of its electrolytic zinc plant until it has more information on the Sterling process, an electrothermic process being developed by New Jersey Zinc. No details have been released on this process, other than the fact that it is an arc furnace operation. This, of course, reminds one of the Trollhattan electric furnace which smelted roasted zinc ore to produce zinc vapors, a fluid slag, and matte. One of the greatest difficulties at Trollhattan was the condensation of the zinc; the new splash condenser of the New Jersey Zinc Co., previously described in this magazine, should be very effective for such an application. The high temperatures of the arc furnace used at Trollhattan increased the volatilization of lead, but again, this should not be too serious a problem for New Jersey Zinc, because it can use its reflux refining columns to remove lead and cadmium to any extent desirable.

The quality of electrolytic zinc at Corpus Christi has been improved by adding to the electrolyte a slurry of strontium carbonate. An addition of 2.2 lb. of $SrCO_3$ per ton of cathode zinc reduces the lead in the cathode from 0.0037 to 0.0015%. The patents state that the addition of 45 lb. of $SrCO_3$ per ton of cathode zinc will give a 90% reduction of the lead in the cathode. It is felt that the addition also has beneficial effects in that it permits deposition at a higher temperature and gives increased current efficiency. However, a recent article by Pecherskaya and Stender, states that additions of alkaline or alkaline-earth metal ions to the electrolyte for zinc deposition lowers the conductivity and hinders diffusion of zinc ions to the cathode.

Corpus Christi is also adding facilities for the treatment of the zinc oxide produced from fuming lead blast-furnace slag. The new facilities will increase the plant's zinc production by 2,000 tons per month.

Slag fuming is a subject of great interest, judging from the large attendance at the round table discussions held at the last AIME meeting with R. R. McNaughton and B. L. Sackett acting as chairmen. Informal discussions were given on operating procedures, equipment construction, and the various metallurgical problems encountered.

A new electrothermic slag furnace at Herculaneum is expected to be in operation by 1953. This furnace has the advantage of recovering the zinc as metal rather than as zinc-oxide fume.

Zinc Fuming at Flin Flon

Hudson Bay Mining and Smelting Co. is operating a fuming furnace on its copper reverberatory slag which carries appreciable zinc. The company expects to start adding zinc plant residues to the reverbs in the near future. These residues, of which there is a stockpile of about 900,000 tons, run 0.15 oz. Au, 3.98 oz. Ag, 1.07% Cu, and 26.5% Zn. Presumably, the copper and precious metals will enter the matte, while the zinc further enriches the slag.

A zinc-fuming plant is being built at ASARCO's Chihuahua smelter and will probably be in operation by the end of 1952.

A recent German article describes the deleading and clinkering of zinc-oxide fume in a Waelz kiln at the Oker smelter. The $PbSO_4$ in the ZnO fume is reduced to PbS at 900° C. and is then volatilized at about 1100° C. The volatility of PbS and CdS can also be utilized to eliminate them in sintering as is explained by Najarian, Peterson, and Lund in their article on sintering practice at the Josephtown Smelter. The sinter for the high-grade circuit is made in two passes. The first pass deliberately makes a soft open sinter from which the more volatile PbS and CdS can escape. The top part of the bed is more nearly free from impurities than the bottom, due to condensation of lead and cadmium compounds in the cooler portion adjacent to the grate. For this reason, the top half of the sinter cake is removed by a special slicing device and is sintered again, after additions of silica, to make a hard dense sinter for the furnaces.

A study of the volatility of metallic sulphides at the Missouri School of Mines and Metallurgy has determined that the apparent vapor pressures of PbS and CdS are approximately 100 times as great as that of ZnS.

The details of sintering practice

are also of great concern to the lead metallurgist. Bunker Hill reports that their D. & L. charge-preparation pilot plant is just now going into operation. They feel that for satisfactory D. & L. charge preparation all ingredients, including fluxes, should be minus-10-mesh. Material, thus prepared, is expected to yield a better sinter and to give a higher SO_2 concentration in the gases. The final grinding of the charge will be done in a dry-grinding rod mill.

Baghouse Replaces Cottrells

Trail reports that they have completed installation of a new baghouse for dust recovery from lead blast-furnace gases; this replaces the Cottrell units previously used. The baghouse is made up of 20 units of 396 bags each; temperatures are automatically controlled by spray cooling and air admission.

In the lead refinery at Trail, a new mechanical sheet-casting machine produces a continuous sheet that is automatically sheared to give starting sheets of the correct length.

Refining of lead by plants handling secondary metal may be complicated by the fact that a new storage battery has been announced which uses a lead-silver alloy. This raises the question of whether any better method can be found for desilverizing than the Parkes process. In a recent article P. I. A. Narayanan and W. L. Chen survey the various methods of desilverizing and come to the conclusion that the Parkes method is the simplest. An investigation by Johannsen and Eicholz both on pilot plant and full-scale operation of the Parkes process have enabled them to prepare a working diagram which gives for various grades of lead: (1) the initial amount of zinc to produce saturation at a given temperature; and (2) the final content of Ag and Zn left in the bullion at any temperature.

Industry Likes Titanium

The titanium boom is going full blast. As Jimmy Durante says, "Everyone wants to get into the act." In addition to du Pont's subsidiary Rem-Cru, and National Lead's Titanium Metals Corp., there have been announcements by P. R. Mallory and Sharon Steel, National Research and Monsanto Chemical, Crane Co., and Horizons Inc. that they propose to go into the titanium business. Many other companies are known to be working on titanium in their laboratories.

Actual production was greatly increased when National Lead got the new titanium plant at Henderson, Nev., under way. It is in a portion of the old Basic Magnesium, Inc., plant and makes use of the facilities for chlorination. Also, it presumably uses the magnesium cells for electrolyzing the magnesium chloride produced as a by-product of the titanium. It is expected that by the end of 1952 it will be producing at the rate of 10,000 tons of titanium metal per year.

Quebec Iron and Titanium's smelter at Sorel has had one furnace in operation since October, 1950, and is currently treating 300 tons of ore per day. It is expected that all five furnaces will be operating at capacity by July, 1952.

Electric-furnace treatment of ilmenite is also the method proposed by the Osaka Special Steel Co. and described in the November issue of *E&MJ*. The furnace slag will carry about 50% TiO_2, and the flowsheet indicates that it will be chlorinated directly. Whether such a step is practical on a commercial scale remains to be seen.

Kennecott is reported to be building a pilot plant with the help of Battelle for producing titanium metal.

Research is Needed

The symposium on titanium at the 1951 AIME meeting drew a large crowd. The automatic arc melting of titanium by du Pont was described in detail and movies were shown. Cylindrical ingots 5¾ in. in dia. and as much as 60 in. long are made by feeding titanium sponge into a melting chamber heated by an arc from a rotating electrode; the ingot is withdrawn continuously from the bottom of the chamber. The sponge, crushed to $-\frac{3}{4}$ in. $+12$ mesh, is melted at the rate of 0.6 to 1.0 lb./min. with a consumption of 64 to 100 kw. When a graphite electrode is used, the carbon pickup is 0.2% C. Greater ductility, formability, and toughness is claimed for the arc-melted titanium. Aside from this interesting paper, the discussion at the symposium consisted of many questions and very few answers.

Research on titanium production has two goals; one is to improve the Kroll process and the other is to find a new method that has some advantage over the Kroll process.

The first objective seems reasonable; certainly the intensive investigations now being made should yield improvements in technique and equipment for the Kroll process that will lower the cost of production and permit operation with larger units. Whether or not the process is continuous does not seem to be too important; after all, copper converters or open hearths are not continuous.

Any truly new process will involve the pyrometallurgical reduction of some compound other than $TiCl_4$ or will involve some electrodeposition scheme. The reduction of TiO_2 does not seem as attractive as the price differential between TiO_2 and $TiCl_4$ disappears. In one plant, high purity TiO_2 is being made by burning $TiCl_4$. A variation of the iodide decomposition process to use crude titanium compounds as a starting material might have many advantages.

Electrodeposition of titanium from a fused salt bath has in the past yielded a brittle metal contaminated with inclusions of electrolyte. It is understood that much research is being done in an attempt to overcome this difficulty.

Experiments on the deposition of Ti from aqueous and nonaqueous solutions have been described by M. L. Holt; among those investigated were solutions in ethyl pyridinium bromide which has been used successfully as an electrolyte for recovery of aluminum. No weighable amount of titanium was obtained from any of the electrolytes.

Work On Zirconium

Zirconium production and commercial uses have been described in several recent articles by G. L. Miller, of the Murex Company in England. He points out that most of the American production, which is chiefly from the Bureau of Mines, has not been available for industry. Murex has a new zirconium plant in production which will supply this highly non-corrosive metal to the industrial consumer. The method used for production is basically the same as that used by the Bureau of Mines, although some details of equipment have been changed. The problem of finding new processes for producing zirconium is almost identical with that described for titanium.

I wish to thank my many friends and correspondents who have patiently supplied information for this review year after year.

MARKETS—Trends and Prices (*Continued from page 69*)

Nickel Consumption in U. S.

Consumption of nickel in the United States, exclusive of scrap, by uses, in pounds of nickel, according to a canvass by the Bureau of Mines:

Use	Covered by Canvass (Percent of Total)	August Pounds	September Pounds	October Pounds
Ferrous:				
Stainless steels	99.5	3,786,009	3,607,819	4,121,783
Other steels	96.5	3,148,679	2,712,599	3,066,739
Cast irons	56.3	403,543	353,545	410,366
Nonferrous (a)	98.7	5,203,968	4,309,308	4,494,629
High temperature and electrical resistance alloys	96.1	1,304,024	1,219,330	1,292,781
Electroplating:				
Anodes	82.4	1,299,157	1,040,831	1,115,522
Solutions	——	23,745	22,277	28,531
Catalysts	94.3	254,594	161,457	216,855
Ceramics	——	18,646	20,042	6,768
Magnets	100.0	123,893	106,701	110,024
Other	80.3	328,683	390,821	373,604
Totals	93.0	15,894,941	13,944,730	15,237,602

(a) Comprises copper-nickel alloys, nickel-silver, brass bronze, beryllium alloys, magnesium and aluminum alloys, Monel, Inconel, and malleable nickel.

Official London Prices

Consumers in the United Kingdom obtain copper, lead and zinc at prices named by the British Ministry of Metals. Delivered prices in effect as January ended were as follows:

	Per Long Ton £	s.	d.
COPPER:			
Electrolytic, high conductivity	227	0	0
Fire refined, high conductivity	227	0	0
Fire refined, high grade	226	10	0
Fire refined, min. 99.7 percent	226	0	0
Fire refined, min. 99.2 percent	225	10	0
LEAD:			
Soft, foreign duty paid	175	0	0
Soft, Empire	175	0	0
English, refined	176	10	0
ZINC:			
Foreign (G.o.b.) duty paid	190	0	0
Domestic (G.o.b.) duty paid	190	0	0
Prime Western and debased	190	0	0
Refined and electrolytic	194	0	0
Minimum 99.99 percent	196	0	0

Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipment, f.o.b. New York unless otherwise stated

MISCELLANEOUS METALS

January 31, 1952

Aluminum, ingot, 99 plus percent, lb. (base price)	19c.
Antimony, spot, lb., 5 tons and up but less than carload, in cases	53.35c.
Bismuth, ton lots, lb.	$2.25
Cadmium, commercial sticks, delivered, lb.	$2.55
Calcium, lb., ton lots, 98 percent, cast	$2.05
Chromium, 97 percent grade, lb., contract	$1.07
Cobalt, 97 to 99 percent, per lb.	$2.40
Indium, troy oz.	$2.25
Nickel, cathodes, lb., f.o.b. Port Colborne (a)	36½c.
Magnesium, 99.8 percent, carloads, lb., producer's plant, Freeport, Texas	24½c.
Palladium, troy oz.	$24.00
Platinum (Official quotation wholesale lots) troy oz.	$90.00
Quicksilver, flask of 76 lbs., 25 flasks or more	$203 @ $206
Selenium, 99.5 percent, lb.	$3.00 @ $3.50
Silicon, minimum 97 percent, carloads, lb.	20c.
Tellurium, lb.	$1.75
Thallium, 100 lb. or more, lb.	$12.50
Titanium, 96 to 98 percent, lb.	$5.00

(a) Includes U. S. duty.

METALLIC ORES

Berryllium Ore, imported, 10 to 12% BeO, per unit	$34.00 @ $36.50
Chrome Ore, per long ton, f.o.b. cars Atl. ports, dry	
44% Cr_2O_3 no ratio	$27.00 @ $28.00
48% Cr_2O_3, 3 to 1 ratio	$43.00 @ $55.00
Iron Ore, Lake Superior, Lower Lake ports, long ton:	
Old Range bessemer	$8.70
Mesabi bessemer	$8.45
Mesabi non-bessemer	$8.30
Lead (Galena), 80 percent, Joplin, Mo., ton	(b) $245.95
Manganese Ore—Per long ton unit of Mn basis 48 percent manganese, nearby positions, subject to premiums and penalties, $1.20 @ $1.25, c.i.f. U. S. ports, duty extra. Long term contract nominal at 90c to 95c., c.i.f., duty extra.	
Molybdenum Ore, 90%, per lb. of MoS_2 f.o.b. mines	60c.
Tantalite, 60% concentrate, per lb.	$2.00 @ $2.50
Tungsten Ore, per unit of WO_3	
Foreign, 60 percent, U. S., equivalent, duty extra	(a) $65.00
Domestic, scheelite, 60 percent f.o.b. mine	$65.00
Vanadium Ore, per lb. of contained V_2O_5 f.o.b. mines	31c.
Zinc Ore, Prime, 60 percent concentrate, Joplin, Mo., per ton	$135.00

(a) F.o.b. port of shipment. (b) Revised.

METALLIC COMPOUNDS

Arsenious Oxide (arsenic trioxide) lb., in bbl. carload lots delivered	6½c.
Cobalt Oxide, 72½ to 73¼%, ceramic grade, per lb.	$1.82 @ $1.84½
Copper Sulphate, 100 lb.	$8.95 @ $9.95

ALLOYS

Beryllium Copper, 4 percent Be, per lb. of alloy, 5 lb. ingot	$1.56
Ferrochrome, 65 to 69 percent, per lb. of Cr contained	21¾c.
Ferromanganese, 78 to 82 percent, gross ton, seaboard	$185.00
Ferromolybdenum, 55 to 65 percent Mo, lb. of Mo. contained	$1.32
Ferrosilicon, 50 percent, per lb. of contained Si	12.4c.
Ferrotungsten, 75 to 80 percent, lb. of W contained	$5.00
Ferrovanadium, per lb. of V delivered	$3.00 @ $3.25
Silicomanganese, Max. 1½ percent carbon, per lb. contracts	9.9c.
Spiegeleisen, per long ton, 19 @ 21 percent grade	$75.00

NON-METALLIC MINERALS

Asbestos, f.o.b. Canada (Quebec) mines (U. S. funds), ton:	
Crude No. 1	$960 @ $1,500
Crude No. 2	$595 @ $900
Spinning fibers	$275 @ $475
Shingle fibers	$123 @ $170
Paper stock	$85 @ $119
Waste	$63 @ $70
Shorts	$30 @ $63
Asbestos, Vermont, f.o.b. Hyde Park:	
Spinning fibers	$279.50 @ $302.00
Shingle stock	$135.00 @ $162.00
Paper stock	$81.50 @ $115.00
Waste, stucco or plaster	$71.40
Refuse or shorts	$34.00 @ $63.00
Barytes, f.o.b. mines:	
Georgia, crude, per long ton	$13.00 @ $13.50
Missouri, 93 to 94 percent $BaSO_4$, per short ton	$10.15 @ $10.40
Bauxite, long ton, f.o.b. point of shipment:	
Domestic, crude, 50 to 52 percent (not dried)	(a) $4.50 @ $5.50
Domestic, chemical, 55 to 58 percent	(a) $8.50 @ $9.50
Domestic, abrasive, 80 to 84 percent	(a) $18.00 @ $18.50
China Clay, f.o.b. mines, ton:	
Georgia, filler and ceramic grades	$8.50 @ $9.50
North Carolina ceramic grade	$20.25 @ $22.25
Feldspar, bulk ton:	
Potash or soda feldspar, 200 mesh, ceramic grade	$18.50 @ $22.25
Glass feldspar, white, 20 mesh	$11.75 @ $12.50
Fluorspar, f.o.b. mines, bulk, Kentucky and Illinois, 70% effective, CaF_2, ton	$43.00
Acid 97% concentrate, bulk, ton	$60.00
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00 @ $14.00
Magnesite, per ton dead-burned, bulk, f.o.b. Washington	$36.30
Mica—Domestic, f.o.b. mines. Punch 12 to 22c. per lb. according to size and quality. Sheet, clear, 1½ x 2 inch, 80 to 85c.; 2 x 2 inch, $1.10 to $1.20; 2 x 3 inch, $1.50 @ $1.60; 3 x 3 inch, $1.80 @ $1.90; 3 x 4 inch, $2.20; 3 x 5 inch, $2.40; 4 x 6 inch, $3.15; 6 x 8 inch, $4.25. Wet ground, very fine, $140 @ $155 per ton. Bulk sales, dry ground: $32.50 @ $70.00 per ton. Scrap, $32 and up.	
Ocher, Georgia, ton, in sacks	$76.25
Pyrites, Spanish, per long ton unit of S, c.i.f. Atlantic ports	Not quoted
Sulphur, Texas, mines, long ton	$22.00
Talc, f.o.b. works, ton:	
New York, purified	$18.50 @ $20.00
Vermont, extra white	$12.50
Tripoli, Missouri, ton:	
40 mesh, cream colored	$35.00

(a) Nominal.

IRON AND STEEL

Pig iron, gross ton, basic, Valley furnaces	$52.00
Steel, f.o.b., Pittsburgh billets, net ton	$56.00
Structural shapes, 100 lb	$3.65

Exide-Ironclad
BATTERIES
ARE YOUR BEST POWER BUY— AT ANY PRICE

They PROVIDE ample power for fast, high-production haulage—more trips per shift, dependable round-the-clock performance, with no end-of-shift slowdown, no unscheduled down time . . . ASSURE inherent safety, with freedom from hazards of fire, fumes, noise . . . SHOW low costs of operation, maintenance, repair, depreciation. SIZES for all makes of battery-powered mine locomotives, trammers, shuttle cars. Call in an Exide Representative and let him prove these facts.

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WASHINGTON IMPACT

Funds for Mineral Expansion Likely— Wilson Stronger as Raw Materials Boss

PRESIDENT TRUMAN'S $85.4-billion budget, largest in history except for World War II, is going to get rough handling in Congress. But the chances are good that what he asks for minerals expansion will be granted. It would mean a big increase in funds to underwrite new output, maybe as much as 50%.

In the fiscal year ending June 30, $600-million was earmarked for minerals expansion. This is Defense Act money. It was administered first by Defense Minerals Administration; now by Defense Materials Procurement Agency (DMPA). It is used by DMPA chiefly to guarantee purchases of scarce minerals at agreed-upon prices, and for advances against production.

For these purposes in the next fiscal year, the one ending June 30, 1953, the President will ask $900-million. Part of it may go for something besides minerals. But the great bulk will be used to expand production of strategic minerals all over the world.

Steel for Trading

Look for more deals of the kind worked out by Truman and Churchill —U. S. getting Canadian aluminum, Great Britain getting U. S. steel. The fact is we have considerable steel that can be used in this kind of trading. A cobalt deal is in the works now. The big prize, of course, would be copper. Top-level mobilization officials have been dickering with Canada for weeks with this in mind.

The aluminum-for-steel deal wasn't barter, in the sense of a government-to-government exchange of raw materials. Under it, Great Britain will simply buy 1-million tons of steel, and we will buy 55.1-million lb. of aluminum this year, with a similar amount to be sold back to Great Britain by mid-1953.

The Administration made the purchase of 20,000 tons of Malayan tin look like part of the steel-aluminum deal. Actually it was a separate transaction. Government publicity linked it with steel and aluminum to gloss over the fact that the U. S. tin policy of the preceding 10 months was being scrapped. The tin agreement is actually government-to-government. Great Britain will turn over 20,000 tons to the RFC at $1.18 per lb.

Tin Decision Strengthens Wilson

For the mining industry, the tin agreement means more than breaking a deadlock on price. It firmly established Chief Mobilizer Charles E. Wilson as the raw materials boss. To put the deal over, he had to ride roughshod over a White House favorite of years' standing, W. Stuart Symington, head of RFC. Just a few weeks before, Wilson won another major victory. He forced Interior Secretary Oscar Chapman to accept Anaconda Copper Mining Co. as an aluminum producer.

The defeat of two such administration stalwarts frees Wilson's hands. For the mining industry, it means centralized responsibility. It doesn't mean the end of the industry's troubles, of course. Wilson has proved a hard man to convince on price, for example. But it does mean that the mobilizers have won the upper hand when it comes to policy arguments with the old-line agencies in the government.

Tin showed what can happen when authority is not clear. RFC is the sole authorized buyer of tin in the U. S. As head of that agency—and cheered on by a Congressional preparedness committee—Symington decided the price was too high. He announced that RFC would not buy any more, except at prices to be negotiated between the agency and producers. He offered $1.12 to Bolivian producers as a starter. They accepted it for a month, then stopped all further deliveries.

The deadlock continued until Wilson stepped in: Symington resigned from RFC, but not because the tin decision was taken out of his hands. He had long intended to quit government service. But even if had stayed, he would have played second fiddle on tin. Wilson and his DPA boss, Manly Fleischmann, worked on the British agreement. RFC was called in only to tidy up a few details.

Two Bad Guesses

Symington miscalculated the tin problem on two counts. First, he thought the Bolivian producers would quickly be forced to agree to a price close to his offer of $1.12. The government-owned smelter at Texas City is the only big one in the world especially designed for the low-grade concentrates we had been buying in Bolivia. Symington figured producers, deprived of a market, would soon be standing in line ready to sign. But they established credit with New York banks, who were willing to loan about 75¢ per lb. at dockside. So Bolivian mines produce, while U. S. reserve stocks dwindle.

Most important, Symington failed to figure on the trail of international complications which was bound to follow his tin boycott. For one thing, it deprived Great Britain of a major source of dollars, by way of Malaya. It caused uneasiness and unrest in Malaya and Indonesia—already hard pressed to handle communist guerillas. It created a furious round of accusations from Bolivia and Southeast Asia that the U. S. was practicing a new type of economic imperialism.

Symington took credit for a drop in the price of tin from around $1.80 per lb. to around $1.10 at Singapore. He can point out that a settlement was finally made at considerably below the price of a year ago. But in the showdown, his price policy had to give way to one designed to provide the U. S. with tin and our allies with dollars.

Tin Once More From Bolivia

The next step will be to resume buying from Bolivians. Because their costs are higher than those of Malayan producers, they will argue for something better than $1.18. If they get it, we are under obligation to pay the British the higher price, too.

In the meantime, RFC jumped the price of tin to U. S. consumers. All during the price deadlock, it kept a price of $1.03 per lb. Four days after the Malayan deal, it changed the price to $1.21½ per lb.—$1.18 under the British agreement, and 3½¢ for shipping.

Policy for Raw Material

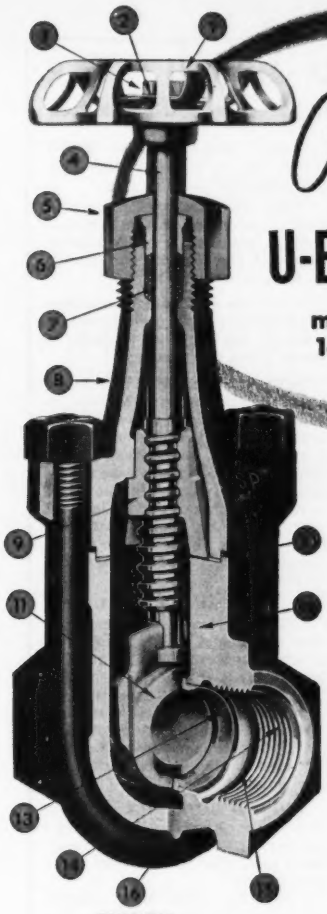
Wilson faces another test of his authority over raw materials. The foreign expansion division of Defense Materials Procurement Agency is handcuffed by a policy difference with the new Mutual Security Administration, successor to ECA. The question is whether money supplied through the Defense Production Act should be used in countries which also obtain MSA funds.

MSA says "No," on the grounds that the extra money would not fit into its carefully balanced programs of social and economic progress. DMPA says "Yes," on the grounds that its job is to get additional raw materials in MSA countries as much as anywhere.

MSA has some money for raw materials expansion—about $38-million. DMPA says it could approve projects for double this amount in MSA countries. It won't do so, however, until President Truman decides the argument. Judging by Wilson's recent successes, he should not have much trouble getting DMPA's point across. To the mining industry, it will mean an additional $38-million to $40-million available immediately as advances against production in

Only Jenkins U-BOLT GATES

measure up to this 16-point standard



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225 lbs. O.W.G.	175 lbs. O.W.G.

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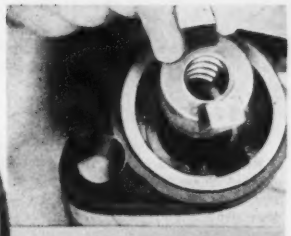

BONNET SAVER BUSHING — No need to junk the bonnet when operating threads are worn. Just slip in a new, patented "Bonnet-Saver Bushing" and have good-as-new thread engagement.

EASY TO CLEAN — You can really get into the bonnet of this valve to clean out the chamber above the operating threads.

RUGGED CONSTRUCTION — Here's proof. When the U-bolt nut was tightened down with a 14" socket wrench until the high tensile steel bolt broke, the heavy duty body and bonnet did not crack!

TROUBLE IS RULED OUT! Check these 16 advanced features—for wear-resistance . . . for ease of maintenance. From handwheel to diaphragm, notice how thoroughly trouble has been ruled out in designing this U-bolt valve. No other valve in its class measures up to Jenkins U-bolt Gate on all these points, many of them exclusive.

You can take it apart and put it together again in two minutes, and it's a cinch to clean. When operating threads become worn, just slip in a new "Bonnet Saver Bushing" and restore it to new-valve efficiency. It's a favorite for those plumbing-heating, mine, mill or any services where excessive sediment is tough on valves and where freezing is a hazard.

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Europe, Africa, Turkey, Philippines and other countries receiving MSA aid.

Still for Cutting Use of Copper

Mobilization officials have toned down their predictions of a practically endless copper shortage. A few weeks ago they were officially telling business groups that the copper shortage would last at least five years. Now they are saying "Five years is longer than we want to try to predict." But there is no sign that they are going to let up on their effort to have industries design copper out of their products as far as possible.

The auto industry is a case in point. NPA allotted auto-makers enough steel for 900,000 cars in the second quarter, but enough copper for only 800,000. An auto takes about 30 lb. of copper for the cooling system. NPA hoped it could push the industry into aluminum or coated steel radiators, to produce the full 900,000. The plan may fail. Copper still works better for radiators than either of these substitutes.

Copper Imports Disappointing

The short-run outlook for copper supplies in the U. S. is discouraging. Biggest disappointment has been failure of imports to equal the allocation granted the U. S. by the International Materials Conference. U. S. got an allocation of 134,000 tons a month for the first quarter. But imports are running about 120,000 tons. This simply points up what the mining industry has said right along: International allocations not tied to firm price agreements won't work. Foreign consumers are getting copper allocated to this country simply because they can pay more than 27.5¢ U. S. users are allowed to pay.

A few weeks ago, officials who allocate refined copper to U. S. industry were counting on 1.7-million tons for 1952. Now they are cutting back their estimates to about 1.6-million tons, very close to the 1951 supply.

Producers say it should be 20,000 to 40,000 tons higher.

Brief But Important

EXPORT-IMPORT BANK approved a $580,000 loan to Cie Aramayo de Mines en Bolivie to expand tungsten production from the Pacuni mine in Bolivia. Most of the loan will be spent for mining equipment in the U. S.

OPS gave up trying to put a price ceiling on rutile. It exempted rutile ores and concentrates from price controls rather than risk interfering with the production of titanium while making a long price study.

THE GOVERNMENT will advance $24,052 to cover 90% of the cost of exploration for uranium ore in Daggett County, Utah. Canary Mining Co., Rock Springs, Wyo., will conduct the exploration.

LABOR THIS MONTH

Joseph M. Gambatese, McGraw-Hill Washington News Bureau

WATCHING COMMUNISTS: No legislation to deal with Communist union leaders will come out of the Senate Labor Subcommittee hearings. Instead, the Defense Department will be encouraged to follow the Atomic Energy Commission policy: Prohibit certain defense contractors from dealing with a Communist-led union. AEC used it against the left-wing United Electrical Workers at General Electric.

UNIONS OBJECT TO MORE LAW: Left-wing and right-wing unions alike oppose any legislative steps against Commie unionists. CIO claims Defense Department has adequate powers to screen Communist sympathizers out of "sensitive" defense work, contends non-Communist affidavit rule of Taft-Hartley proves failure of legislative approach to the problem of Communist union leadership. The left-wing Mine, Mill and Smelter Workers brand the Senate Committee hearings a "union-busting" trick of the CIO steel workers to help them in their "raids" in mine-mill.

DAILY WORKER PLEASE COPY: The *Daily Worker's* story on the Mine-Mill executive board's blast against the hearings adds another bit to the growing evidence of how close this nonferrous mining union works with the Communists. The Communist newspaper published Mine-Mill's press release, word for word, as its own news story.

COMMUNISTS FOR SPEED-UP: Commie union leaders rant against what they call "speed-up." They attack the government's plan for allowing wage increases for increased productivity as "speed-up" in disguise. They rave about utopian working conditions in Russia. Actually, recent issues of the U.S.S.R. Information Bulletin reveal the fraudulence of this anti-American propaganda and expose Russia as (1) a great believer in the speed-up and (2) denying workers the collective bargaining privileges they enjoy in the United States. We quote:

"Stakhanovites (production-line heroes) appreciate the time factor in their work and they have learned to measure time not only in minutes, but in seconds."

"P. Bykof, a lathe operator of a machine-building plant, has developed methods of high-speed metal cutting and has attained a cutting speed of more than 6,560 ft. per minute instead of the 328 ft. formerly achieved."

"Labor productivity in Soviet enterprises in 1951 has risen 10% over last year."

"The Trade Unions . . . enforce strict observance of the principle that payment shall be in accordance with the quantity and quality of work performed . . ."

In articles discussing how unions function in Russia, no mention is made of any right of workers to strike. They don't have it.

DEFER APPRENTICES: Local draft boards are being allowed to defer skilled apprentices in approved apprenticeship programs. It's the young workingman's "college" deferment to help ease shortage of skilled labor. But he must have been in training at least a year, or only six months if the job he is training for is on the Labor Department's "list of critical occupations."

COPPER MINING IS CRITICIZED: CIO leaders Walter Reuther and James Carey blame the government and mining companies for shortages of copper causing local unemployment problems in automobile and electrical manufacturing. They want mining companies to raise copper output through high-cost mining rather than shift to aluminum.

AROUND MINE-MILL: The executive board opposes higher copper prices, favors another premium price plan for high-cost marginal mines.

Politically, Mine-Mill doesn't like "Ike," the Democrats, the Republicans or (anymore) the 1948 campaigner for left-wing unions, Henry Wallace.

Mine-Mill is having trouble with members for its support of Russian foreign policy. No revolt is brewing, however. The anti-Communists who could lead another uprising have left the union.

SUIT HURT UNIONS: Unions are finding out how costly it can be under Taft-Hartley to induce a jurisdictional strike or violate a contract. Reason: employers' suits for damages. In upholding $750,000 in damages awarded to Juneau Spruce Corp. against Harry Bridges' Longshoremen's Union, the Supreme Court said:

The collection of damages from a union for engaging in unlawful jurisdictional activity is a matter for consideration only by the Federal courts. It is not necessary for an employer also to get a finding from NLRB that the union had violated the Unfair Practices Section of Taft-Hartley.

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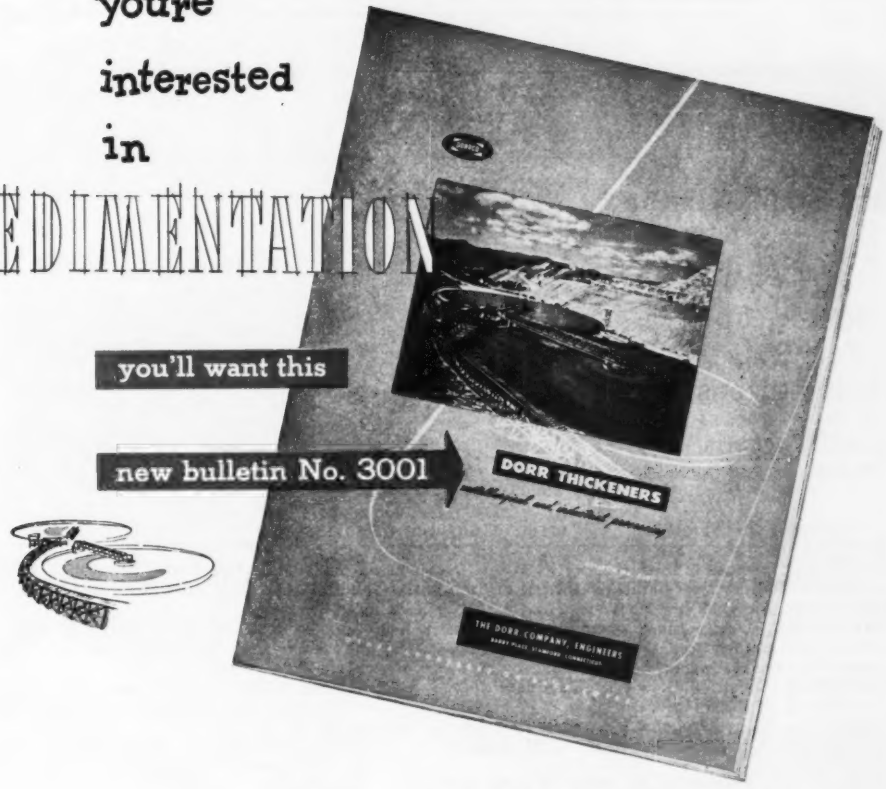
new bulletin No. 3001



Bulletin #3001, "Dorr Thickeners for chemical, metallurgical and industrial processing" has just come off the press. Containing 28 pages of descriptions, drawings and photographs, it covers the comprehensive line of Dorr Thickeners briefly and factually. If you're concerned with thickening problems and the equipment with which to solve them, you'll find it helpful. Write for your free copy today.

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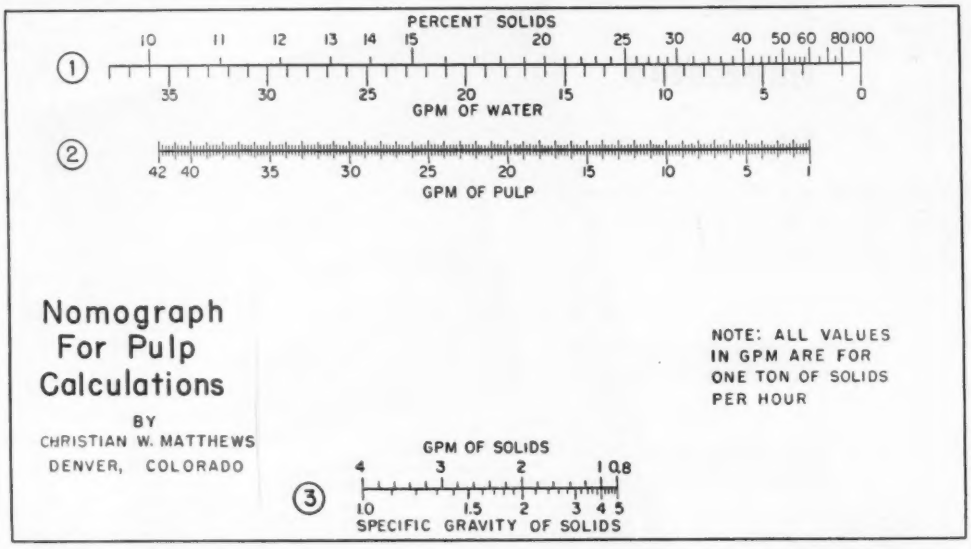
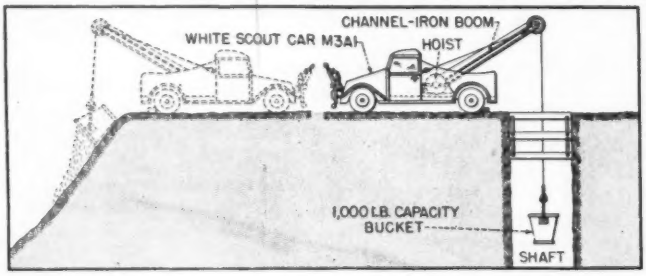
OPERATING IDEAS


PERCENT SOLIDS
10 11 12 13 14 15 20 25 30 40 50 60 80 100
1
35 30 25 20 15 10 5 0
GPM OF WATER
2
42 40 35 30 25 20 15 10 5 1
GPM OF PULP
Nomograph For Pulp Calculations
BY
CHRISTIAN W. MATTHEWS
DENVER, COLORADO
NOTE: ALL VALUES IN GPM ARE FOR ONE TON OF SOLIDS PER HOUR
GPM OF SOLIDS
4 3 2 1 0.8
3
1.0 1.5 2 3 4 5
SPECIFIC GRAVITY OF SOLIDS

GIVEN: Any *2* of the following:
% solids, Specific Gravity of Solids or USGPM of Pulp
REQUIRED: Any *1* of the above
PROCEDURE: Locate the 2 given quantities on the chart and connect them with a straight line. The answer is then read from the third scale.
EXAMPLE I: Given: S. G. = 4.3, % Solids = 45%
Req'd: USGPM of Pulp.
Connect specific gravity of 4.3 on scale "3" with 45% solids on scale "1", and read 5.8 GPM of pulp on scale "2".
Remember this answer is the value of pulp per ton of dry solids. For values of solids other than 2,000 lb./hr., correction must be made.
EXAMPLE II: Given: Specific Gravity of ore = 4.3
Required: To determine how many GPM of water must be added to dilute a pulp from 45% solids to 25% solids, if the rate of feed is 2,000 #/hour.
Solution:

1. Connect S. G. of 4.3 on scale "3" with 45% solids on scale "1", then read 5.8 GPM on scale "2"
2. Connect S. G. of 4.3 on scale "3" with 25% solids on scale "1", then read 12.8 GPM on scale "2"
3. GPM to be added to accomplish the desired dilution equals the difference, or 12.8 — 5.8 = 7.0 GPM.

For your reference,
1 ton (short) = 2,000 lb. (1.00)
1 ton (long) = 2,240 lb. (1.12)
1 ton (metric) = 2,204 lb. (1.10)



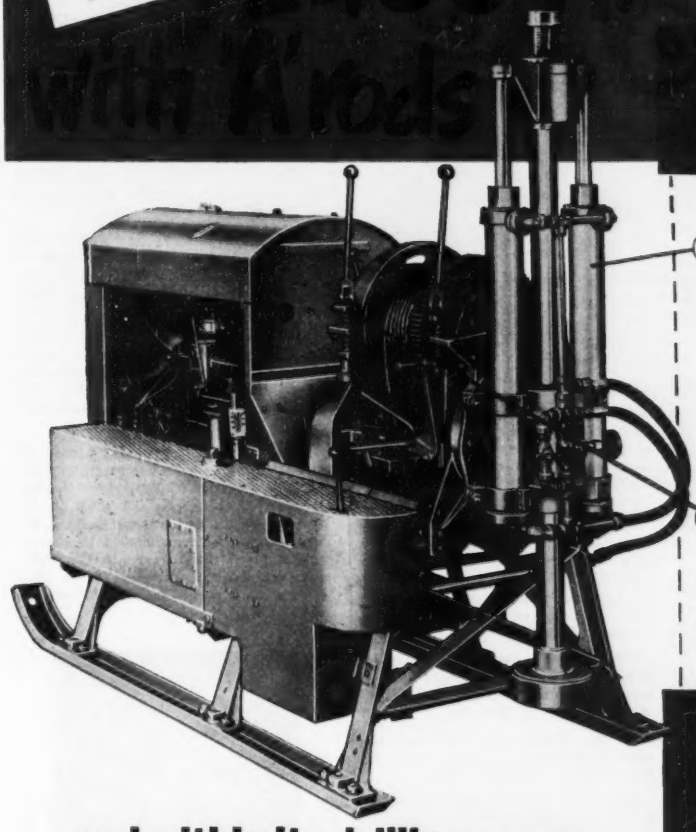
Mobile Hoist for Shallow Shafts

On its National Copper property, Day Mines, Inc. had to rehabilitate a shallow two-compartment shaft for ventilation and emergency exit. Ordinarily, such a job would have involved construction of a headframe, installation of a hoist and some means of disposing of timber and waste brought to the surface. By using the remodeled war-surplus White scout car (left), this expense was eliminated. The scout car served as a headframe, hoisting plant, and waste-disposal system all in one. No men were hoisted or lowered in the bucket.

Day Mines' garage foreman, Elmer M. Talvi, equipped the scout car with a short channel-iron boom and hoist. The hoist is powered through a Braden S6B-2 Take-Off, 5099 XB1 Adapter, and finally a chain drive. Through a telescopic arrangement, the control clutch can be operated from either the cab or the rear platform.

The unit performed satisfactorily to a depth of 200 ft.

NOW 2400 ft. with A rods



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1 NEW 12AH SWIVELHEAD

. . . a light twin cylinder hydraulic swivelhead for use with "A" or "B" equipment (I.D. of drive tube, $2\frac{1}{16}$"). It combines high speed with operating economy and minimum weight—2560 lbs. as illustrated.

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CAPACITIES:
"E" rods: 2400 ft.—$\frac{7}{8}$" core.
"B" rods: 1500 ft.—$1\frac{5}{8}$" core.
"N" rods: 1300 ft.—$2\frac{1}{8}$" core.
"H" rods: 900 ft.—$2\frac{3}{4}$" core.

POWER: 70 H.P. Gasoline or Diesel.

An increasing number of our diesel powered units are giving highly satisfactory performance in the field.

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- ✔ most economical

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PERSONAL NEWS

DR. FRANCIS C. FRARY (left) organizer of Aluminum Company of America's research laboratories at New Kensington, Pa., has retired after 33 years with the company. His successor is DR. KENT R. VAN HORN, formerly associate director of research.

John Paul Dyer, vice president and director, has retired after 22 years with Phelps Dodge Refining Corp., New York, N. Y.

Texas Gulf Sulphur Co., New York, N. Y., has announced the elections of **Richard T. Fleming** as vice president and general counsel and **E. F. Vanderstucken, Jr.** as secretary.

S. R. Zimmerley, with the U. S. Bureau of Mines for 23 years, has resigned to become director of research for Kennecott Copper Corp.'s Western Mining Division, Salt Lake City, Utah.

J. Bruce Clemmer has been named chief of the Intermountain Experiment Station and head of the Metallurgical Branch, Region IV, U. S. Bureau of Mines. Headquarters will be Salt Lake City, Utah.

L. J. Randall has been elected president of Hecla Mining Co. Mr. Randall formerly served as secretary-treasurer. **Ralph W. Neyman** has been promoted from general mine superintendent to general manager. Chairman of the Board **A. W. Witherspoon** temporarily held both positions, resigning because of ill health.

Jack Drew, Hollinger Mining Co., Timmins, Ont., has been appointed assistant foreman of grade control. **Cliff McFadden** is now with the Personnel Department.

A. F. Carper has resigned from Tungstar Corp., Bishop, Calif., to open his own office as Professional Consulting Mining Engineer and Mining Geologist, 212 S. 16th St., Las Vegas, Nev.

O. Cutler Shepard, professor of mining and metallurgy, has been appointed head of the Technology Division of Stanford University School of Mineral Sciences in California. He succeeds **Frederick G. Tickell**, retired.

Ralph L. Wilcox has joined the American Smelting and Refining Co.'s sales department, New York, N. Y., in an executive capacity. Mr. Wilcox was former chief of the Non-Ferrous Metals Branch of the Economic Cooperation Administration.

Don R. Purvis has been named superintendent of the Ground Hog unit of American Smelting and Refining Co. Mr. Purvis succeeds **T. A. Snedden**, transferred to the Silver Bell open pit mine of Asarco, near Tucson, Ariz.

Edward C. Leonard, Ishpeming, Mich., is now safety director for Inland Steel Co. mining operations in Michigan and Minnesota.

George Taylor has been appointed chemist in charge of Lerch Bros., Inc. laboratory at Crosby, Minn.

Brig. Gen. William W. Wanamaker, U.S. Army, retired, has been appointed chief engineer of the Orinoco Mining Co., New York, N. Y. Orinoco is U.S. Steel's Venezuelan iron ore mining subsidiary.

William Lessard is now general foreman at the Wentworth mine, Interstate Iron Co., Mesabi Range, Minn.

Walter P. Weber has been appointed assistant to the general manager, R. W. Whitney, at M. A. Hanna Co., Hibbing, Minn. **Leo J. Lambert** succeeds Mr. Weber as chief clerk.

Fred D. Hoover has been named supervisor of training for Oliver's eastern district.

James Boyd, former director of the U. S. Bureau of Mines, has been appointed exploration manager of Kennecott Copper Corp., New York, N. Y. **George Ordonez** is chief geologist.

Lowell B. Moon, chief of the minerals division of the U. S. Bureau of Mines, will join the exploration staff of Kennecott Copper Corp. in the New York offices. **L. S. Breckon** has been promoted to the position of district geologist with headquarters in Sydney, Australia.

M. H. Dorenfeld is now a metallurgist with the Southwestern Engineering Co. in the ore-dressing laboratory, Inglewood, Calif.

Charles L. Knaus has been named new sales manager for the Geo. S. Thomson Co., El Paso, Tex.

Miles P. Romney, Salt Lake City, Utah, has been named secretary-manager of the Utah Mining Association. **Walter M. Horne** is assistant manager.

Manuel Villafana, chairman of the Mining Development Commission, is touring U. S. mining zones to observe opportunities for collaboration between the U. S. and Mexico under the Point IV program.

A. Q. Lundquist has been promoted to assistant general superintendent of Colorado operations for United States Vanadium Co., a division of Union Carbide and Carbon Corp. **J. F. Brenton** has been promoted to superintendent of plants for the Colorado area. **R. D. Van Zante** succeeds Mr. Brenton as plant superintendent at Rifle, Colo.

JOHN C. KINNEAR is retiring as vice president after 41 years with Kennecott Copper Corp., New York, N. Y. Mr. Kinnear has been named assistant to Charles Wilson as metals specialist in DPA.

Art Johnson has been promoted to maintenance supervisor for the Inter-State Iron Co.'s Mesabi Range mines, Minn. **Ingwald Peterson** succeeds Mr. Johnson as master mechanic at the Hill-Annex mine.

W. J. Kaiser has retired as general superintendent of Oliver Iron Mining Co.'s eastern district operations. Mr. Kaiser had been with the company for 45 years. He was made eastern dis-

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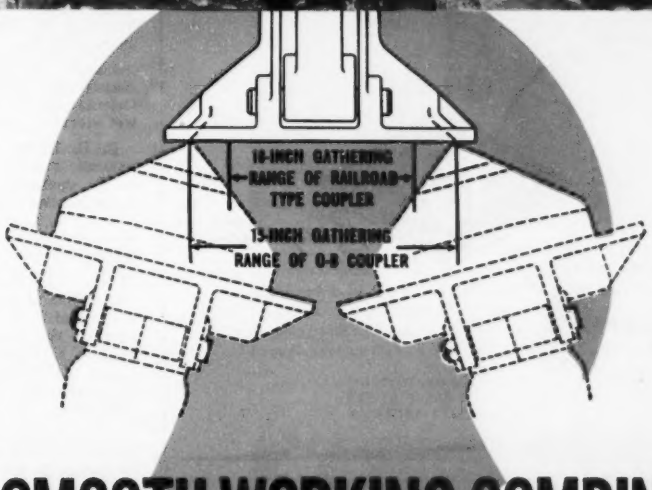


IT'S A SMOOTH-WORKING COMBINATION

when these couplers put their heads together

Acting without the guiding hands of a trip-rider or motorman, O-B Mine Car Couplers put their heads together automatically. In so doing, they speed the gathering and coupling operations in a busy haulage system, and help to get more loaded cars to the dump each shift. Even on short-radius curves, dips, or knuckles, the wide gathering range over which these O-B couplers operate makes sure that one head will guide the other as they join, and that each will make a secure connection with the other.

"Joining securely on impact" is the best description of what happens when O-B couplers put their heads together. It is also one of the best features you could want for your haulage system. When it's time to replace present couplers or replace your cars, call in an O-B representative. You will be pleased with the coupler suggestions he can make when you put your heads together!

Ohio Brass

MANSFIELD OHIO, U.S.A.

CANADIAN OHIO BRASS CO., LTD., NIAGARA FALLS, ONT.

trict general superintendent in 1937, general superintendent in 1945. **Ira O. N. Swanson** has been appointed to succeed Mr. Kaiser. **Joseph M. Johnson, Eveleth,** and **Lloyd S. Campbell,** Virginia, Minn., have been appointed assistant general superintendents.

S. Gray Farrar has been appointed manager of the mining division of Mindus Corp., Ltd., Toronto.

Ernest D. LeMay, after 40 years with Tennessee Coal, Iron and Railroad Co., 15 years as public relations director, has retired. **John L. Mortimer** succeeds Mr. LeMay as Southeast district public relations director with headquarters in Birmingham, Ala. **Stephen T. McGinnis** has been promoted to associate director of the Southeast district and **R. Clay Bailey** has been appointed director of the Gulf-Southwest district.

James Neubauer, former pit boss at the Arcturus mine; **Clement F. Hanson,** former pit boss at the Gross-Marble mine; **Leonard R. DeCaigny, Jr.,** former pit boss at the Gross-Marble; and **Clarence W. Bergquist, Jr.,** former tractor operator at the Arcturus mine, have been named pit foremen of the Gross-Marble mine of the Oliver Iron Mining Co., Mesabi Range of Minnesota.

...A Name You Can Trust

FOR YOUR ANALYTICAL WORK, you are always assured of dependability when you "specify B&A Quality Reagents". This is because Baker & Adamson makes no compromise on the purity of its reagents. Each is precision-made to meet the rigid, *pre-determined* specifications of the American Chemical Society itself!

WITH REAGENTS not covered by A.C.S. specifications, Baker & Adamson establishes its own exacting standards of purity—comparably high . . . equally dependable.

OVER 1,000 high purity products bear the familiar B&A Shield of Quality. They are available from B&A's own nation-wide chain of distributing points to save you time and money in laboratory operations. For your needs, *specify B&A Reagents* . . . first choice of American chemists since 1882.

REAGENTS B&A STANDARDS OF PURITY FINE CHEMICALS

BAKER & ADAMSON *Reagents*

GENERAL CHEMICAL DIVISION

ALLIED CHEMICAL & DYE CORPORATION

40 RECTOR STREET, NEW YORK 6, N. Y.

Offices: Albany • Atlanta • Baltimore* • Birmingham* • Boston • Bridgeport* • Buffalo* Charlotte* • Chicago* • Cleveland* • Denver* • Detroit* • Greenville (Miss.) • Houston* Jacksonville • Kalamazoo • Los Angeles* • Minneapolis • New York* • Philadelphia* Pittsburgh* • Providence* • St. Louis* • San Francisco* • Seattle • Yakima (Wash.)

In Wisconsin: General Chemical Company, Inc., Milwaukee, Wis.

In Canada: The Nichols Chemical Company, Limited • Montreal* • Toronto* • Vancouver*

SETTING THE PACE IN CHEMICAL PURITY SINCE 1882

* Complete stocks are carried here.

Gene Thomas has been appointed northwest district representative for Frank G. Hough Co., Libertyville, Ill.

William B. Tobey has left Vananda Mines, B. C., to assume management of Ute Mine for the Colorado Standard Lead Zinc Mines, Inc., Santa Barbara, Calif.

Bhagwan M. Maniar is now working as a junior metallurgist for Northern Peru Mining & Smelting Co., Trujillo, Peru.

Charles A. R. Lambly has resigned as general superintendent of the Pend Oreille Mines & Metals Co., Metaline Falls, Wash., and the Reeves MacDonald Mine, Ltd., Salmo, B. C., to become assistant manager of the mining department of American Metals Co., New York, N. Y.

John C. Howbert, Ironwood, Mich., has been appointed chief mining engineer of the Gogebic District, Oliver Iron Mining Co. Mr. Howbert succeeds **Theodore G. Roy,** retired after 23 years with the company.

Charles V. Harris is now with Nickel Processing Corp., Nicaro, Oriente, Cuba, as superintendent of wet storage, drying and grinding.

B. E. Hurdle has been appointed general superintendent, Kimberley, B. C., operations, for The Consolidated Mining and Smelting Company of Canada, Limited. **P. S. Barratt** is now superintendent of the company's engineering department, Kimberley Operations.

Canadian Ingersoll-Rand Co. Ltd. has named **T. M. Parr,** Toronto, manager of the company's branches at Toronto, Kirkland Lake, and Timmins. **J. N. Robertson** became assistant sales manager with headquarters in Montreal.

A. F. Beynon is now employed as mine superintendent by Cia. Minas de Passagem in Minas Gerais, Brazil.

Jay Mayhew, formerly with Great Lakes Carbon Co., in Arcadia, Calif., has opened headquarters in Albuquerque, N. M., of the Utah Mud Co. in partnership with **Sid Low,** also of California.

Robert I. Williams is now shift foreman in the pit department of the Ray Mines Division, Kennecott Copper Co., Ray, Ariz.

R. M. Belliveau is now consultant in open pit-mining methods for American Smelting & Refining Co., New York, N. Y.

P. George Maercky, vice president, has resigned from Texas Gulf Sulphur Co., New York, N. Y., because of ill health.

John M. Brooks, Jr., has retired as general manager of Minas de Mathambre, S. A. Present address: 4608 Cumberland Circle, El Paso, Tex. **George R. Schaefer,** formerly assistant general manager, has succeeded Mr. Brooks.

Nathan M. Levine. formerly with the Department of Mining and Metallurgy of the University of Wisconsin, has joined the Department of Mineral Engineering, Columbia University, New York, N. Y.

Northwest Mining Association's officers for 1952 are:

President—**E. C. Stephens,** geologist for Anaconda Copper Mining Co., Spokane, Wash.

Vice president—**David E. Watson,** secretary of Thomas Consolidated Mines, Inc., Spokane, Wash.

Second vice president—**Joseph C. Kieffer,** general manager of Spokane-Idaho Mining Co., Kellogg, Idaho.

Treasurer—**E. K. Barnes,** banker, Spokane, Wash.

L. W. Spang has been appointed secretary of M. A. Hanna Co., the post vacated by the late **William C. Scott.**

M. L. Campbell is now mill superintendent with the B. S. & K. Mining Co., Phoenix, Ariz.

Robert S. Palmer, secretary of the Colorado Mining Association, has been called to Washington as a consultant to Howard I. Young, deputy director of DMPA.

Roger V. Pierce, consulting engineer from Salt Lake City, Utah, recently returned from Minas de Matahambre, Pinar del Rio, Cuba, and is headed for Cerro de Pasco, Peru.

Frank McKinley has resigned from Bunker Hill & Sullivan Mining and Concentrating Co., Kellogg, Idaho, to join Humphreys Gold Corp., Jacksonville, Fla., as plant superintendent.

William J. Waylett has resigned as assistant research engineer with Anaconda Copper Mining Co., Butte, Mont., to join the Atomic Energy Commission as special assistant to the director of the Raw Materials Division in Washington, D. C.

Arthur H. Underwood has resigned as mine shift boss at the Hollinger Mine, Timmins, Ont., to work as an engineer at the King Mine, Asbestos Corp., Ltd., Thetford Mines, Que.

C. H. Williams has been appointed assistant executive vice president—engineering and raw materials, United States Steel Co., Pittsburgh, Pa.

J. P. de Wet has retired as secretary of the Manitoba Chamber of Mines and as editor of *Precambrian.*

C. D. Osterland was re-elected as president of the Manitoba Chamber of Mines. **W. S. Sparrow** and **A. E. Smith** were elected first and second vice presidents. **L. B. Figgins** was appointed secretary of the chamber and editor of *Precambrian.*

C. S. Parsons has retired as director of the Mines Branch, Canadian Department of Mines and Technical Surveys.

Carlos A. Hieber is now a consultant in metallurgical work in Boston Harbor, Wash.

roof bolting accepted

for SAFETY
ECONOMY
BETTER "HOUSEKEEPING"

Roof bolting has been established in coal mining as an improved method of roof support. Metal mines have investigated the use of roof bolts and as a result the leading metal producers of the West have accepted them as a means of obtaining better "housekeeping" with safer and more efficient production. For detailed information consult the U. S. Bureau of Mines or CF&I mining engineers.

THE CALIFORNIA WIRE CLOTH CORPORATION, OAKLAND
THE COLORADO FUEL & IRON CORPORATION, DENVER
WICKWIRE SPENCER STEEL DIVISION, NEW YORK

MINE ROOF SUPPORT BOLTS

THE COLORADO FUEL AND IRON CORPORATION CF&I

OBITUARIES

Bethune Glass Klugh, 71, noted scientist of Monsanto Chemical Co., died Dec. 27 in Birmingham, Ala. Mr. Klugh was an outstanding authority on phosphate rocks and metallurgical ores.

John Bernard McGee, treasurer and a director of the Miami Copper Co. and of several other mining companies with headquarters in New York, N. Y., died at 74 on Dec. 18.

Professor Oscar A. Dingman, 62, died in Missoula, Mont., on Dec. 16. Professor Dingman was a member of the faculty of Montana School of Mines since 1927, president of the Montana Society of Engineers, and a member of the Montana Bureau of Mines and Geology.

Earl L. Brokenshire, 59, ore sales manager of Oglebay, Norton and Co., passed away Dec. 16 in Columbus, Ohio. Death was caused by a heart attack.

Charles F. Smith, 70, president of the Smith Engineering Works, Milwaukee, Wis., died Dec. 10 at Pasadena, Calif. Mr. Smith was also vice president of the Sterling Wheelbarrow Co., West Allis, Wis.

TEAMWORK IN SPECIALTIES

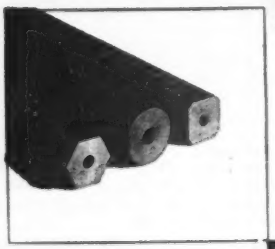
the drill runner...

CRUCIBLE HOLLOW DRILL STEEL

The drill runner is a busy guy—continuous boring through hard rock with high-speed drills. His job efficiency is dependent not only on his skill...but on the tools he uses. That's why in almost all drilling operations you'll find Crucible Hollow Drill Steel the number one choice.

This quality steel is built to take the punishment of around-the-clock operation of modern, high air-pressure rock drills. And you have the assurance of minimum breakage . . . and an end to expensive bit loss. That's because Crucible Hollow Drill Steel is backed by the experience of specialty steelmakers.

Insure the quality of your job—cut costs—use Crucible Hollow Drill Steel.



CRUCIBLE first name in special purpose steels

52 years of Fine steelmaking

HOLLOW DRILL STEEL

CRUCIBLE STEEL COMPANY OF AMERICA, GENERAL SALES OFFICES, OLIVER BUILDING, PITTSBURGH, PA.
REX HIGH SPEED • TOOL • REZISTAL STAINLESS • ALLOY • MACHINERY • SPECIAL PURPOSE STEELS

E&MJ

NEW PRODUCTS DIGEST

For further information on items listed, circle item numbers on reply card [illegible]

FEATURES

A New Unit for Milling Plants
The WEMCO Attrition Machine

A NEW METALLURGICAL and industrial processing unit—the WEMCO Attrition Machine—has just been announced by Ralph B. Utt, general manager of Western Machinery Co., San Francisco, Calif. Extensive field tests and laboratory investigations show that this unit will have wide application in ore dressing, coal preparation, sand and gravel beneficiation, and chemical and other industrial processes.

NEW WEMCO ATTRITION MACHINE cleans surfaces of mineral particles, and liberates sand cemented with various materials.

What It Does

The new machine does two things, singly or in combination:

(1) Treats mineral particle surfaces. The attrition machine removes slime, oxidized surfaces, and reagent coatings undesirable for further processing. This cleansing and polishing action is highly beneficial in the treatment of minerals which have to be prepared to meet rigid market specifications.

(2) Liberates cemented particles. In ores where particles are held together with a cementing material, the new machine liberates the grains from the cementing material. This action has specifically been applied to sandstones where grains were cemented by a material containing clay and finely divided minerals. (Editor's Note: This should be of great interest to carnotite producers on the Colorado Plateau where the ores are essentially sand, cemented by soft micaceous-textured minerals.)

How It Operates

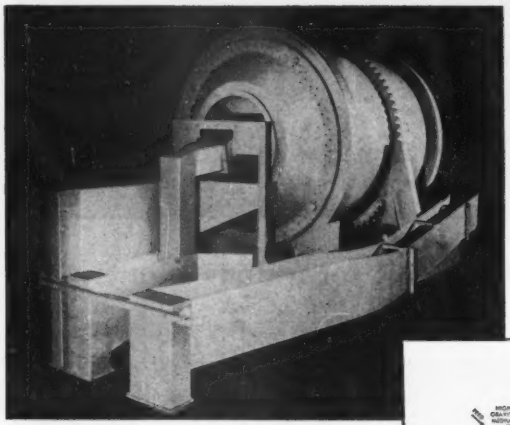
WEMCO's attrition machine uses controlled turbulence of high-density pulp as an operating principle. This action stimulates the rubbing of particle against particle. Optimum density depends on the nature of the material treated. To date best results were obtained with 83% solids for several materials.

The machine is made up of two, four, or six octagonal-shaped cells operating in series, and mounted on a common base. Each cell includes a motor-driven vertical impeller shaft on which are mounted three 6-bladed impellers. Pitch of the impellers in each cell is alternated so that in Cell No. 1, the top impeller throws the pulp downward, the middle impeller throws the pulp upward, and the bottom impeller throws the pulp downward. Rotation is clockwise, and the pulp passes from Cell No. 1 to Cell No. 2 through an opening near the bottom of the partition between the two cells. In Cell No. 2 the impeller pitches and direction of rotation are opposite to those in Cell No. 1, and the pulp flow to Cell No. 3 is through an opening near the top of the partition between cells.

For more information circle No. (1) on the convenient reply card opposite page 150. **(1)**

HIGHER CONCENTRATE GRADES

...lower tailings



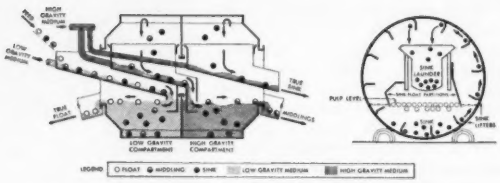
THE WEMCO DOUBLE DRUM

is the only Heavy-Media Separator producing ***three*** *products by* ***absolute**** *gravity control*

Ores amenable to HMS and containing middlings are now successfully treated to produce an **optimum grade concentrate, lower tailings,** and an **accurately segregated middling** that can be reprocessed for maximum metallurgical extraction.

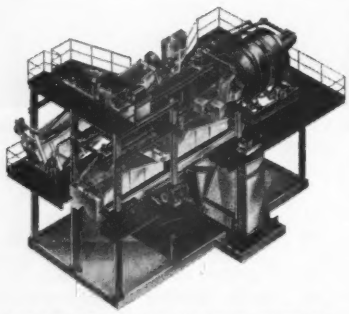
LOW CAPITAL INVESTMENT AND OPERATING COSTS

The superior metallurgical results of a two stage process are accomplished in **one** drum and **one** media reclamation circuit. There is no unnecessary duplication. Cost is a minimum.



A POSITIVE OPERATING PRINCIPLE

- True float is separated by a low gravity media in 1st compartment, while sink passes to 2nd compartment.
- True sink and middlings are separated by a high gravity media in 2nd compartment.
- Both high and low gravity media remain uniform and constant in density in their respective drum compartments.
- Overflow of float material and lifting of sink are simple, effective actions.
- The entire separation is accomplished within one unit.



AVAILABLE IN MOBIL-MILLS

For ores having middlings, Wemco Double Drum Separators are furnished as the separatory vessels with Wemco Mobil-Mills—the prefabricated HMS plants used by the majority of Heavy-Media operators throughout the world.

Ores requiring less complex treatment are beneficiated in Mobil-Mills using popular single compartment Wemco Drum Separators or the efficient Wemco Cone Separator, depending on the nature of the separation involved.

★ Absolute gravity control provides **positive** separation of the middling by the use of a homogeneous medium. This prevents the lower grades and recoveries common with the partly heterogeneous actions of other types of separating units.

***Write today** for information on your problem. Mobil-Mills are available in various sizes to treat up to 250 t.p.h.*

WEMCO

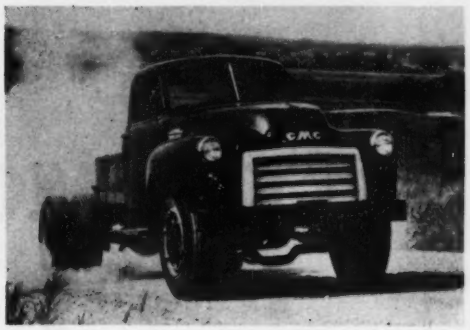
WESTERN MACHINERY COMPANY

760-768 FOLSOM STREET · SAN FRANCISCO 7, CALIFORNIA

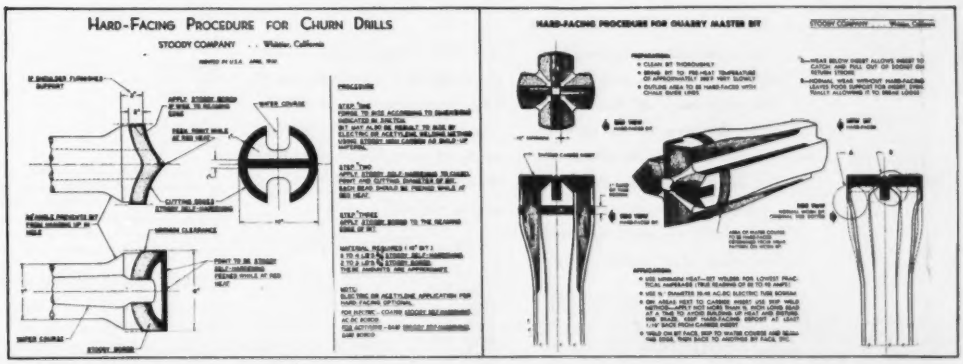
OTHER **WEMCO** PRODUCTS

Mobil-Mills • Coal Spirals • HMS Thickeners • HMS Pumps • Sand Pumps Cone Separators • Drum Separators • Fagergren Laboratory Units • Agitators Fagergren & Steffensen Flotation Machines • Hydroseparators • S-H Classifiers HMS Laboratory Units • Dewatering Spirals • Thickeners • Conditioners • Densifiers

NEW CUTTING TORCH. Gasoline is the fuel used in this cutting torch made by Browning Torch Corp. which with oxygen will cut, braze or scarf economically. Seventy cents' worth of gasoline will do as much work as 100 cu. ft. of acetylene. (2)

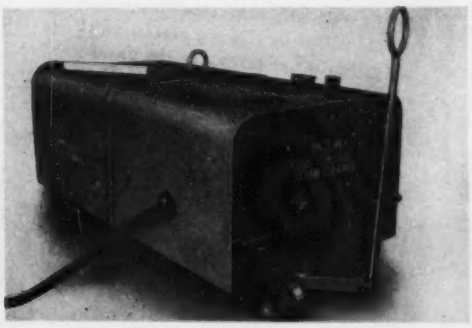


GMC'S NEW 2½-TON TRUCK operates with a three-cylinder diesel. For the first time in trucking history the efficiency of the diesel engine has been introduced into equipment of the 2½-ton weight class. For more information circle No. (3) on the reply card. (3)



IF YOU WANT INFORMATION on the methods of hard-facing Quarry-Master bits and churn-drill bits, as presented by the Stoody Co. of Whittier, Calif., just circle No. (4) on the convenient reply card. (4)

BURRO WITH A BUILT-IN WEIGHTOMETER. If you add a single pound to Susie's 135-lb. load, she will stage a sit-down strike. She will not sit down with this load because it weighs only 125 lb.—but consists of 1,200 ft. of Carlon ½-in. dia. pipe—only ⅛ as much as metal pipe. Want to know more about the pipe? Circle No. (5) on reply card. (5)



STEAM CLEANER. You can't expect your mechanics to do a thorough job of repairing equipment if they have to work in gobs of dirty grease. This new unit made by Mine Safety Appliances Co., Pittsburgh, Pa., will do a thorough job of removing all traces of dirt and grease so that the crews can spend their time on repairing instead of cleaning. (6)

Introducing a Revolutionary

WILMOT-DANIELS Heavy-Density Unit

Completely Eliminates Loss of Product to Refuse. Cuts Requirements of Costly Magnetite Medium Sharply Maintains Remarkably Constant Density of Bath.

The remarkable operating records of the new Wilmot-Daniels Heavy-Density unit have given real substance to its title of "revolutionary". Its sharp advances in efficiency, yield and quality control are suggested by the field records shown here. Featuring also radical simplicity and compactness, it has cut costs in a way that means new carry-over to profit for coal and metal producers. May we send you a file of field test reports together with engineering details?

You Are Invited

TO SEE the Wilmot-Daniels Heavy-Density unit installed at the Indian Head colliery, Tremont, Pa., pictured below.

TO READ the article about the Wilmot-Daniels Heavy-Density cleaning process which appeared on pages 90-93 of the January issue of Coal Age.

Left, Indian Head Coal Co., Tremont, Pa.

BATH SPECIFIC GRAVITY

	Circuit 1	Circuit 2
7:00 AM	1.65	1.71
7:30 AM	1.65	1.71
8:00 AM	1.65	1.71
8:30 AM	1.65	1.71
9:00 AM	1.65	1.71
9:30 AM	1.65	1.71
10:00 AM	1.65	1.71
10:30 AM	1.65	1.71
11:00 AM	1.65	1.71
11:30 AM	1.65	1.71
12:00 M	1.65	1.71
12:30 PM	1.65	1.71
1:00 PM	1.65	1.71
1:30 PM	1.65	1.71
2:00 PM	1.65	1.71
2:30 PM	1.65	1.71
3:00 PM	1.65	1.71
3:30 PM	1.65	1.71
4:00 PM	1.65	1.71
4:30 PM	1.65	1.71
5:00 PM	1.65	1.71

The above actual operating results at Indian Head colliery graphically demonstrate how the Wilmot-Daniels Heavy-Density unit unfailingly maintains accuracy of bath density, resulting in more efficient product cleaning.

HEAVY DENSITY PERFORMANCE

Test No.	Primary Float	Refuse to Bank % COAL	BONE
1	*circ.	0	0.5
2	circ.	0	4.0
3	circ.	0	2.5
4	circ.	0	3.5
5	circ.	0	2.0
6	circ.	0	1.5
7	circ.	0	0.0
8	circ.	0	1.0
9	circ.	0	3.5
10	circ.	0	3.0
11	circ.	0	2.0
12	circ.	0	5.0
13	circ.	0	2.5
14	circ.	0	4.5
15	circ.	0	2.0
16	circ.	0	2.5
17	circ.	0	1.0
18	circ.	0	0.0
19	circ.	0	1.5

**Indicates coal produced well within standards for anthracite.*

During normal operation at the Indian Head breaker the new Wilmot-Daniels unit showed that the common problem of loss of coal to refuse can, for the first time, be eliminated.

WILMOT ENGINEERING CO.
HAZLETON, PA.
Plant: WHITE HAVEN, PA.
HEAVY DENSITY DIVISION

For Your Files

This informative manufacturers' literature is free unless otherwise specified. To obtain bulletins circle their numbers on card below and mail.

HAMMER MILL. A new unit—the "Pulverator"—is announced by Allis-Chalmers, Milwaukee 1, Wis., in an interesting booklet containing specification drawings, cut-away illustrations, performance data, and a discussion of operating principles. (36)

DUST AND FUME CONTROL. American Wheelabrator & Equipment Corp., Mishawaka, Ind., has just published a new 36-page catalog describing various sizes and models of "Dustube Collectors" (cloth-tube type) and listing advantages to be gained from the use of cloth filtration. (37)

"STANDARDIZATION — KEY TO ECONOMY"—That's the title to a useful booklet issued by Caterpillar Tractor Co., Peoria, Ill., which tells you how to save money by using equipment powered by related "Caterpillar" machines. For instance tractors, graders, power shovels, draglines, electric sets may be powered by diesel engines which have interchangeable parts. (38)

CYCLONE CLASSIFIER. Your file on classifiers will not be complete until you circle No. (39) on the card below. This will bring you a neatly illustrated bulletin telling how the DorrClone classifying unit works, where it can be used, and what it will do. It is made by the Dorr Co., Stamford, Conn. (39)

WOOD PRESERVATION MANUAL. Here's your chance to get the latest information and advice on wood preservation. (With present timber prices higher than a kite, you can't afford to overlook this one.) Just circle No. (40) below, which will bring you a copy of "The American Wood Preservers' Association Manual of Recommended Practice." AWPA headquarters are in Washington 6, D.C. (40)

RESCUE UNIT. Mines Safety Appliances Co. of Canada, Ltd., Toronto, Ont., has developed a new "Self-Rescuer"—a small, compact, lightweight device which will protect the wearer for 30 minutes in carbon-monoxide concentrations found after fires or mine explosions. (According to the U.S. Bureau of Mines, concentration of CO as low as .04% can be fatal.) This unit should also permit emergency entrance of areas where powder blasts have just occurred. (In Ontario a number of deaths have been reported where ventilation failed to clear out CO created by mine blasting.) (41)

CONTRACTORS' EQUIPMENT. Ransomes & Papier, Ltd., 32 Victoria St., London, England, offers a new catalog describing and illustrating their line of hand and power-tilting concrete mixers, non-tilting mixers, truck mixers, roller-pan mixers, self-priming gasoline-powered water pumps, excavators, pan vibrators, and mobile cranes. (42)

SAFETY CONNECTING LINKS. Interstate Drop Forge Co., Milwaukee 16, Wis., makes a new type of "Wedge-lock" connecting link for repairing or connecting all sizes of chain up to 3 in. A folder is available illustrating and describing this product. (43)

RADIAMETRIC PYROMETERS. If you want a good handbook on radiametric pyrometers, circle No. (44) below. This will bring you Minneapolis-Honeywell Regulator Co.'s (Philadelphia 44, Pa.) new catalog No. 9,300 showing where and how to install radiametric pyrometers. (44)

WELDING DIRECTORY. Eutectic Welding Alloys Corp., New York, N.Y., has released a new welding directory covering a complete line of welding products and their application. A handy chart is included which tells what type of rod to use on each of a large number of metals and alloys. (45)

FUEL OIL HEATERS. Various types of steam-type heaters for heavy grades of fuel oil are described and illustrated in a new catalog by Hauck Mfg. Co., Brooklyn 15, N. Y. (46)

WHITE PRINTS. You can make black and white prints of drawings, tracings, letters, reports, etc., for less than 2¢ per sq. ft., and in as little as one minute. To find out how, circle No. (47) below. This will bring you a copy of Peck and Harvey Co.'s new bulletin on the subject. Address, Chicago 45, Ill. (47)

MAGNETIC SEPARATORS. Jeffrey Manufacturing Co., Columbus 16, Ohio, has released a new catalog covering their complete line of magnetic cobbers, counter-glow magnetic separators and separators for heavy-media plants. (48)

EVAPORATORS. A complete line of evaporators, useful for treating manganese sulphate, salt, barium chloride, sodium sulphate, calcium chloride, trisodium phosphate, di-sodium phosphate, potassium chloride, zinc chloride, caustic soda, and many other salts, is described and illustrated in a new catalog by Swenson Evaporator Co., New York 7, N.Y. This company also makes drum vacuum filters, and spray dryers which atomize and dry many types of salt in solution. (49)

ELECTROTHERMAL HEATING TAPES. This product is useful for pilot and production plant operation. Just twist the tape around a conduit, glass or otherwise, and apply an electric current to the tape, and you have a simple, quick method of heating the content of the pipe. Who makes the tape? E. Machlett & Sons, New York 10, N.Y. Circle No. (50) and let them tell you more about this product. (50)

USE THIS CONVENIENT CARD

to obtain further information on products and bulletins mentioned in the New Products Digest. Circle item numbers, tear out and mail.

Not good after May 1, 1952, if mailed in U. S. or Canada.

NOT GOOD AFTER MAY 1, 1952—If mailed in U. S. or Canada February, 1952

Please send me the catalogs or further information about the items from New Products Digest whose numbers are circled.

1	8	15	22	29	36	43	50	57
2	9	16	23	30	37	44	51	58
3	10	17	24	31	38	45	52	59
4	11	18	25	32	39	46	53	60
5	12	19	26	33	40	47	54	61
6	13	20	27	34	41	48	55	62
7	14	21	28	35	42	49	56	63

My Name ..... Position .....

Company .....

Address .....

Equipment Shorts

LIQUID STAINLESS STEEL. If you have corrosion problems in your mine, mill, or smelter, it will pay you to circle No. (20) below. This product made by Slip-On, Inc., New York 13, N. Y., consists of tiny flakes of 18/8 stainless steel in a binder of carefully selected plastics. It can be used to coat wooden tanks, and steel or other metal surfaces. It makes the surfaces resistant to chemical action of salt, alcohol, gasoline, sodium hydroxide, sulphuric acid, hydrochloric acid, nitric acid, and other corrosive or abrasive materials. (Need we say more to hydrometallurgists and smelter operators?) (20)

TORQUE CONVERTERS. The Schneider torque converter is licensed for installation to the following companies: Borg-Warner Corp., White Motor Co., Clark Equipment Co., Western Gear Works, and R. G. LeTourneau. This unit is made by Schneider Mfg. Corp., Muncie, Ind. It comes in sizes from 5 to 500 hp. The unit consists of three-bladed wheels—a pump, a turbine, and a reaction member which combine the advantage of the hydraulic torque converter and the fluid coupling. (21)

HOPPER CAR UNLOADER. Lippman Engineering Works, Milwaukee 14, Wis., makes a new hopper car unloader. The unit is portable, and slides under a hopper bottom car with ease. Bulk cargoes are transferred laterally from beneath the car to an elevating conveyor. This equipment can unload as much as 300 tons of coal per hour. (22)

HYDRAULIC SHOCK ABSORBER. The simple installation of a Greer hydro-pneumatic accumulator in the hydraulic system of a bucket loader, power shovel, bulldozer, etc., will eliminate the excessive shocks that the hydraulic system imposes on mechanical parts because of the incompressible nature of fluids. To find out how to cut down maintenance bills on hydraulically-operated equipment, circle No. (23) on the card below for a copy of Greer Hydraulics, Inc.'s new booklet, "How to Absorb Shocks." Address: Brooklyn 15, N. Y. (23)

SPACE HEATERS. E. K. Campbell Co., Kansas City 3, Mo., makes space heating equipment suitable for heating mine headframes, machine shops, and other buildings. (24)

FOG NOZZLE. A wide range of fog nozzles, atomizing from 2 to 200 gpm of water is made by Bete Fog Nozzle, Inc., Greenfield, Mass. Since the modern accent is on fire fighting with fog, this item should attract the special interest of the man in your mine who is in charge of fire prevention. (25)

WIRE ROPE LUBRICANT. "Texaco Crater A" is the name of a new wire-rope lubricant with unusual penetration and adhesion properties made by The Texas Co., New York, N. Y. It is a thin liquid which is applied without heating. It will not drip or evaporate in hot weather, nor will it drip from a wet wire rope. (26)

STERLING ELECTRIC MOTORS, Inc. has started up production in a new $2-million plant at Van Wert, Ohio, according to Earl Mendenhall, president. Gears, splines, and gear boxes will be produced here. Employees at the plant will total about 400. E. O. Danielson will be in charge of the new plant as well as Sterling's plants in New York and Los Angeles. Sterling also has plants in Hamilton, Ontario, and Santiago, Chile, and is one of the nation's leading makers of variable-speed and geared electric motors. For more information about the Sterling line, circle (28) on post card below. (28)

HEAVY-DENSITY PROCESS. Wilmot Engineering Co., Hazleton, Pa. makers of coal and ore-dressing equipment, has acquired the Daniels-Roller Heavy-Density process, a product of H. J. Daniels & Co., Inc., also of Hazleton. The association of the two companies was jointly announced by George L. Wilmot and Herman J. Daniels, presidents respectively of the two companies. The Wilmot-Daniels Heavy-Density units are being installed in the anthracite fields of Pennsylvania and the iron ore operations of Alabama. For more information on the Heavy-Density process circle (29) below. (29)

GAS-BURNING ENGINES. Kaiser Aluminum and Chemical Corp.'s new Chalmette, La., aluminum reduction plant is equipped with 80 Nordberg gas-burning radial engines which will supply about 150,000 hp. Nordberg Mfg. Co., Milwaukee 7, Wis., has prepared one of the finest bulletins ever to cross our reviewing desk, illustrating and describing these interesting engines. The bulletin is prepared in color with numerous transparencies to illustrate the intricate details of mechanical design involved in these efficient engines. Nordberg's new engines burn gas, oil, or dualfuel, and will be of interest to companies with large power requirements. (30)

JET-PIERCING. Linde Air Products Co., New York 17, N. Y., explains how a high-temperature supersonic flame can be used to "drill" rock in a new pamphlet entitled "Jet-Piercing—Key to Taconite Development." This unit is good for primary and secondary blast-hole "drilling." (31)

POWER TRANSMISSION ELEMENTS. Dodge Manufacturing Corp., Mishawaka, Ind., announces a complete line of power transmission units including "Torque-Arm" speed reducers, roller bearings, sheaves, belts, clutches, hangers, collars, pulleys, conveyor pulleys, roller-bearing take-ups, sleeves, bearings, flexible couplings, and rigid couplings. The Torque-Arm unit provides instant protection for driven machine, motors, and speed reducers. (35)

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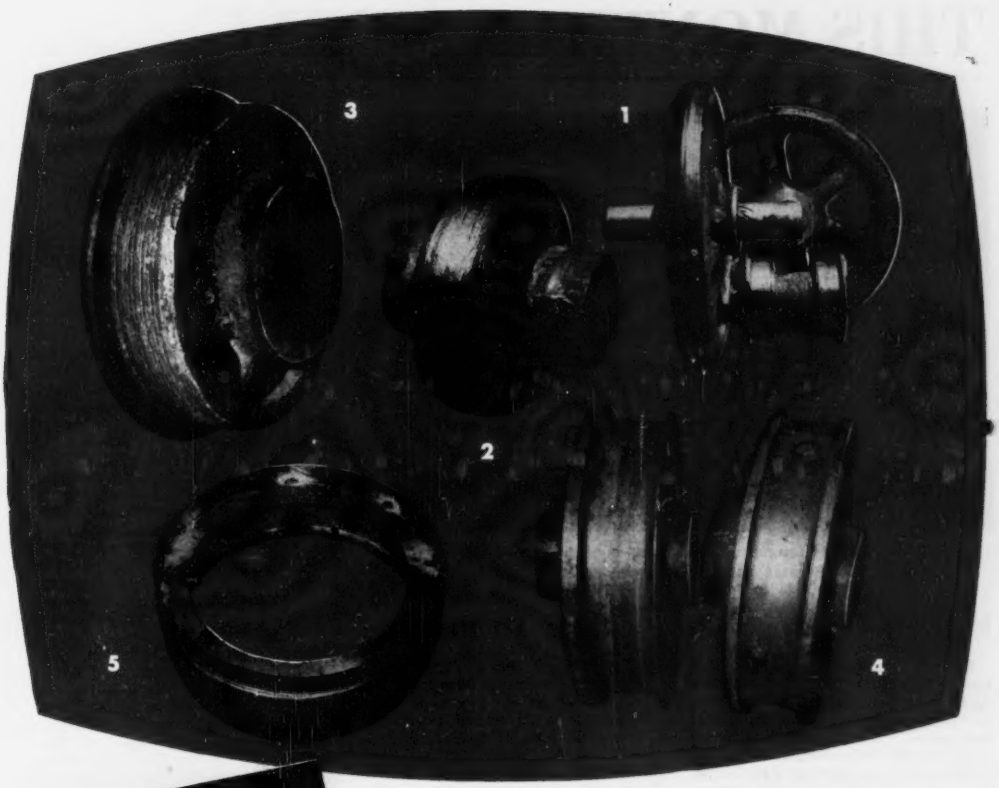
to obtain further information on products and bulletins mentioned in the New Products Digest. Circle item numbers, on reverse side, tear out and mail.



1. SHOVEL IDLERS
Built up and hard-faced automatically with Stoody 105, this shovel idler and tractor roller are exceptionally smooth and long wearing.

2. SHOVEL ROLLS
Note the even deposit on this shovel roll. Stoody 105 will at least double its useful life—save hours of downtime.

3. MINE CAR WHEELS
Mine car wheels sustain heavy wear from track debris. Stoody 105 retains size and roundness—keeps wheels on the job under difficult conditions.

4. CRANE WHEELS
Here, unprotected and hard-faced crane wheels are compared. Note wear evident on flange of unprotected wheel, left. Stoody 105 has held size on wheel at right.

5. BRAKE DRUMS
Surface of this brake drum is automatically hard-faced with Stoody 105 and subsequently machined. Resulting smooth surface far outwears unprotected drum.

STOODY 105 keeps the wheels of industry turning . . .

with less wear—less down time—less cost

Everywhere you look—in almost any industry, you see wheels in use. Some work *in* earth, others operate metal against metal . . . *but almost all are subject to heavy abrasion, loss of size, loss of life!* The quick, sure way to reduce wear . . . to keep these wheels of industry rolling . . . to cut maintenance is to hard-face with STOODY 105! It's a time-tried, proven procedure that saves equipment and dollars and reduces the need for hard-to-get replacements.

See your Stoody Dealer—600 in U. S. and Canada—for friendly help, or write direct.

STOODY COMPANY

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STOODY 105

APPLIED BY AUTOMATIC OR MANUAL ELECTRIC WELDING

THIS MONTH IN MINING

C. P. LOVE, works manager at Chalmette, inspects one of the pigs which went into the first shipment of metal from the new plant.

Kaiser's Chalmette Plant Starts To Produce

Kaiser Aluminum and Chemical Corp. shipped the first aluminum from its new plant at Chalmette, La. on Dec. 14—just three days after the metal was poured. The shipment of pig metal went by rail to the corporation's aluminum extrusion plant at Halethorpe, Md., where it will (or has) become extrusions for airplane parts.

Kaiser's Chalmette plant will eventually be the largest aluminum reduction plant in the United States. It was originally planned as a plant to produce 200-million annual lb., but late in 1951, the eventual size was increased to 400-million annual lb.

Chalmette is the second to produce of the great crop of new U. S. aluminum plants, plants which were planned as a result of the Korean war. Chalmette's full production of 400-million annual lb. will not come until sometime in 1953, at which time the productive capacity of U. S. aluminum will be nearly twice as great as in 1951.

Lavender Pit Will Start Production in '54 or '55

In a statement to stockholders, Louis S. Cates, chairman of the board, Phelps Dodge Corp., reported as follows:

"Work is diligently being carried on toward developing the Lavender open-pit mine at Bisbee, mentioned in the annual report to stockholders for 1950. The orebody contains 41,000,000 tons of concentrating ore of an average grade of 1.14% copper; 31,000,000 tons of material to be leached, of an average grade of 0.42%; and 70,000,000 tons of waste which will have to be moved. The concentrator will have a capacity of about 12,000 tons of ore per day. The estimated cost of bringing the mine to the producing stage and installing the necessary plant and equipment to treat the ore is about $25,000,000. The company is paying all the cost of the project. The Government, however, has a commitment to purchase a certain portion of the production.

"The Lavender open-pit project will take about four years to complete, hence no production is to be expected from this source until 1954 or 1955."

Reynolds Will Build New Alumina Plant

Richard S. Reynolds, Jr., president of Reynolds Metals Co. announced that the company will build a new alumina plant adjacent to the aluminum-metal plant it is now building in San Patricia County, Tex. (near Corpus Christi). Estimated cost of the plant is $42-million; completion date, January 1953; capacity, 1,000 daily tons of bauxite ore. Bauxite ore would come from the extensive deposits which Reynolds Jamaica Mines, Ltd., a subsidiary company, is now developing. Alumina output of the new plant would go next door to the metal plant which Reynolds is now building and plans to begin operating late this year. This new integrated ore-to-metal plant will be one of few such in the world.

Reynolds has begun engineering, and has issued a letter of intent to build the plant. The letter went to C. F. Braun & Co., of Alhambra, Calif., the prospective builder.

Eichelberger and Eddy To Operate Talisman

Frank Eichelberger and his associate, E. E. Eddy, have agreed to take over active management of Talisman Mining and Leasing Co.'s properties at Laurier, Wash., according to Henry T. Born, president of Talisman.

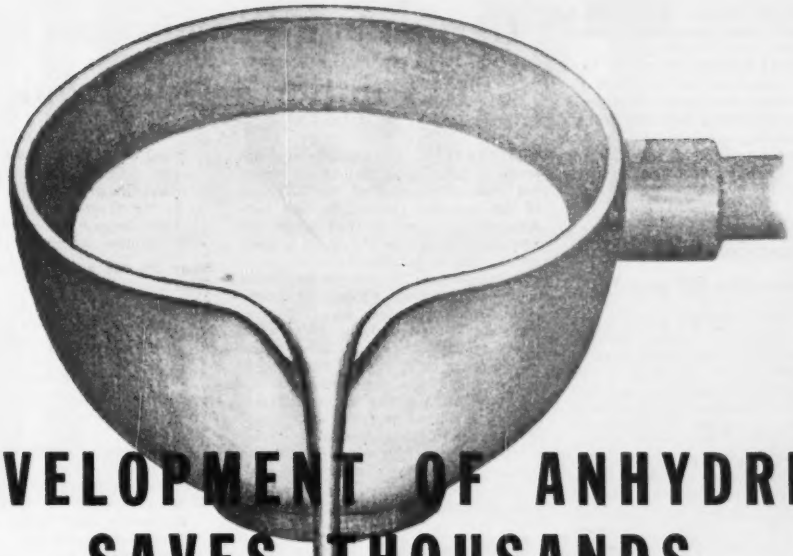
Talisman had been granted a DMA loan of $44,000 for exploration and development. Eichelberger's staff made a comprehensive examination of the properties, and then closed this deal; under it they will match the DMA funds and put up other capital that will be needed to put the property into production. In return, Talisman will split profits 50-50 with the new operators.

The Talisman has tungsten, cadmium, copper, zinc, lead, and silver values; is equipped with a 75-ton flotation mill; and is served by the Great Northern Railway. The 3,000-ft. tramway was recently overhauled by Riblet Tramway Co. Mr. Eddy will supervise operations which were to start as soon as weather permitted.

Garfield Installs Bank of Mechanical Punchers

R. D. Bradford, western department manager of the American Smelting & Refining Co., has announced installation of a bank of mechanical punchers on one of eight converters in use at the Garfield copper smelter. After a thorough study of cost factors and the operation of the initial mechanical unit, there are indications that further mechanical punchers will be applied to speed the blister copper output of the plant.

The punchers are similar in design to those in use at the McGill operation of the Nevada Division of Kennecott Copper Corp., where they were developed by mechanical department engineer Byron T. Berge and the late Leonard Larson, former general superintendent of the McGill reduction facility. Fifty punchers, acting as a bank, were installed at one McGill converter in 1950, a second unit was placed in operation a year ago, and a third bank is due to be installed in 1952, making McGill the only reduction plant in the world where all converters are punched mechanically. Indications are that an increase of



DEVELOPMENT OF ANHYDREX SAVES THOUSANDS OF TONS OF LEAD

Research sometimes pays large and unexpected dividends. When Simplex was developing the first rubber-jacketed underground cable, our object was to eliminate the use of lead in order that you might have lighter cables, ones that were easier to install and were very much easier to splice.

Now it appears that another dividend, unexpected but valuable nevertheless, has accrued from this research work. In fact, the development of the first rubber-jacketed underground cable has opened the door to enormous savings of one of our vital national resources.

Today millions of feet of cables that without Simplex research would have required thousands of tons of lead for cable sheaths, are operating dependably in all types of jobs from airport lighting to railway signaling. Instead of being used for cable sheaths this lead can now be used for much more important service for everything from storage battery plates to tetraethyl lead for gasoline.

ANHYDREX is only one of many improvements in the art of cable manufacture to come out of Simplex Research and Development Laboratories.

SIMPLEX ANHYDREX

SIMPLEX WIRE & CABLE CO 79 SIDNEY ST CAMBRIDGE 39, MASS

blister copper output of from 15 to 20% results when mechanical punching replaces hand-punching.

The initial Garfield converter bank utilizes compressed air to force the pushing rods in and out of the tuyeres. Previous engineering difficulties inherent in adapting mechanical punching devices to the motions of the charging and discharging converters are reported successfully overcome.

New Process May Produce Titanium for $2 per Lb.

Of his new titanium process, Dr. Arthur J. Kerbecek Jr. says, "Possible cost of producing the metal appears at this time to be less than $2 per lb." But he emphasizes the fact that it is still by no means a commercial process. Dr. Kerbecek developed the process on a laboratory scale during research for his Ph.D. at Columbia University. The thesis which he wrote will be withheld for two years (as are most scientific theses at Columbia). With patents now pending, Dr. Kerbecek plans to develop the process on a commercial scale.

The Process: Anhydrous titanium tetrachloride (the technology of producing it is pretty well established) is reduced electrolytically to titanium metal. The product is a sponge, similar to the sponge produced by the Kroll process. In the thesis work, a nugget of 98.5% purity was produced —not pure enough and thus not ductile enough to be commercial. Refining to remove impurities, presumably iron, aluminum and salts of the bath, would be necessary to produce a marketable grade of metal.

As Dr. Kerbecek says, "The basic attributes of the process are continuity of operation, low operating temperature, and direct recovery of chlorine in the cell. The chlorine can then be used for ore chlorination in a complete cyclic process; make-up chlorine could be purchased or produced as needed."

Advantages: The process is thus economical in use of chlorine, and it eliminates the need for magnesium—buying magnesium and setting up a plant to electrolyze magnesium chloride.

Greater Butte To Start in February, 1952

Starting sometime this month, the Greater Butte Project will begin regular production. Starting at a low rate, ore production will rise to about 6,000 to 7,000 daily tons of 1% copper by the end of 1952; at that time, metal production will be at the rate of about 20,000 annual tons; and in two or three years, it will rise to the eventual rate of about 45,000 annual tons of metal. All of this copper will be in addition to the production from Butte's existing selective mines.

Germanium Promises an Early Revolution in Electronics

UTILIZATION of the electrical properties of germanium may be the greatest scientific-industrial development of the last five years. The new germanium units are of two kinds—an amplifier, otherwise known as a transistor; and a rectifier.

Development of the units came about with surprising speed. Scientists of Bell Laboratories built the first transistors in 1948; but they were of the catwhisker type (similar to the old detector on a crystal radio set), and they had distinct limitations. In 1950, the same group from Bell developed the junction transistor; freed of the catwhisker's limitations, the junction transistor (made by a newly developed metallurgical technique) promises to replace units all the way from the vacuum-tube amplifier to the heavy-duty power rectifier.

What is a transistor? It is a small unit which consists of two kinds of germanium crystals; both are essentially a very pure germanium containing slight, carefully regulated additions. The first kind of crystal is called the P-type (for Positive); it is deficient in electrons, usually because of additions of such elements as boron, aluminum, gallium, indium. The second kind of crystal is called the N-type (for Negative); it has an excess of electrons, usually because of additions of such elements as nitrogen, phosphorus, antimony, arsenic. The transistor which will replace amplifying tubes is a newly devised kind called the junction transistor; it consists either of a layer of P-type germanium between two layers of N-type, or the reverse; the first is called the N-P-N transistor, the second the P-N-P. The center layer is the control layer, and is analogous to the grid of the vacuum tube. A typical junction transistor is about 3/16 in. in diameter and contains about .0002 lb. of germanium.

What is a germanium rectifier? The first ones were low-power devices, many of which are now in use. Then, improved rectifiers (N-P units similar to the transistor) brought the power output to about 0.2 amperes at 200 volts. The latest development, to quote the February issue of *Electronics*, is this: "Even in the heavy-current field, the promise is nearly a reality. In theory an area the size of your little fingernail (one square centimeter) of single-crystal germanium will rectify 1,000 amperes, and 300 amperes has actually been carried in practical tests. This puts the germanium rectifier in the heavy-duty class, quite possibly a competitor to the thyratron and ignitron in such large scale applications as resistance welding control."

What are the advantages of a transistor?

1. **Small size.** For such uses as hearing aids, proximity fuses, the size advantage is obvious. Actually the saving of space is just as important in large units (such as the giant electronic computers, the size of which is getting out of hand).
2. **Low power requirement.** An amplifier circuit (one stage) using the transistor requires only about 1/1,000 to 1/1,000,000 of the power used by an equivalent vacuum-tube circuit.
3. **Long life.** The earliest transistors (several years ago) had a life of about 70,000 hours. Since then the life has been greatly extended. Louis N. Ridenour, now chief scientist of the air force, said in the August 1951 *Scientific American* that "in principle a properly made transistor should last forever if not abused."
4. **Reliability.** This is a direct result of long life. It is a factor of prime importance in such circuits as transcontinental relay circuits, where each voice or signal depends on the proper performance of every one of 10,000 or so vacuum tubes. (Every time your cross-country TV program blanks out, think of the transistor.)
5. **Resistance to shock.** Being very simple and compact, the transistor is much more resistant to vibration and mechanical shock.
6. **Instant starting.** A transistor needs no warm-up.

Who makes the transistor? It was invented by scientists from Bell laboratories. Bell's subsidiary Western Electric, and also Sylvania, General Electric, RCA and most other electronic organizations are pushing development and/or production of transistors.

What is germanium? It is an interesting substance usually called a metal, but which might better be called a semi-metal. It is intermediate in properties between the non-metals carbon and silicon and the metals tin and lead. It forms a number of organo-germanium compounds (GeH_4, Ge_2H_6, . .) that are very similar to hydrocarbons. It is a grayish-white semiconductor (has about 42,000 times the resistance of copper, but much

you can't beat progress...

These two 4-yd. electric shovels have played a big part in the successful change to open pit mining at Inspiration Consolidated Copper Mines at Inspiration, Arizona. A third P&H will provide increased production to meet the growing need for copper.

ELECTRIC P&H SHOVELS

All the advancements in electrical digging made by P&H have one common purpose — *lower tonnage costs.*

Here's *faster operation* with such P&H improvements as Magnetorque* Hoist Drive, stepless power regulation . . . independent propel for faster move-ups.

Here's *steadier digging* — many of the old mechanical devices which caused trouble and delay are eliminated — no slip friction clutches; no sliding gears to shift, no electrical contactors in main control system.

Here's *lower maintenance cost* — all-welded construction originated by P&H — induction-hardened gearing — filtered air cab.

When you put these, and other progressive P&H ideas to work, you're sure of lower tonnage costs in all kinds of open-pit operations.

P&H leads the field in electric shovel developments.

*T. M. of Harnischfeger Corporation for electro-magnetic type clutch.

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Every third P&H Electric Shovel sold is a repeat order

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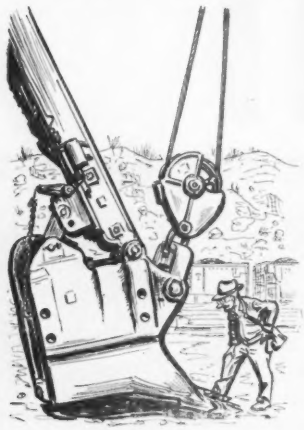
CAPTION CONTEST WINNERS



The Best Captions

"Ruff, Ashe, Parfet, Duel, Dittman, Rob'nson, Schlue, Bradley, Briggs, Lambertson, Evans, Overstreet, Hatch, Peart, Hoy, Miller, Morgan. Go ahead! I was just checking to see if you were all on the job." *First Place; $5.00; Herman E. Knight, Engineer of Mines, Madisonville, Ky.*

"Sorry, folks, the trailer camp is one block west." *Second Place; $4.00; Theo. A. Schmidt, c/o Le Roi Co., Cleveland, Ohio.*

"Is this the tooth that's been bothering you?" *Third Place; $3.00; F. W. Bloecher, Jr., American Cyanamid Co., Watertown, Mass.*

"A little drip by a big dip." *Fourth Place; $2.00; L. L. Edgerton, Rare Metals Mine, Kingman, Ariz.*

"They told me if you fill up the back of the shovel, the point will take care of itself!" *Fifth Place; $1.00; C. A. Dobbel, American Zinc Lead & Smelting Co., St. Louis, Mo.*

The Most Captions

"American Expositionary Farce."
"Sir, you're APT—to be SCRAPPED."
"A claws call, I'd say."
"His PULL-ITICS need a BIT of watching. Agree?"
"Bon Voyage, Sir!"
"BURY nice man with a BIT of nonsense." *Special Prize; $1.00; Mrs. Arthur Ladd, Ellensburg, Wash.*

Other Entries

"No! No! Not in there, please, McDougal." *Herman E. Knight, Madisonville, Ky.*

"Cheer up, boys, the Boss has ordered an AMSCO Dipper to replace this heap." *Thomas A. Ratkowski, Excavator Sales Engineer, American Manganese Steel Division, Chicago Heights, Ill.*

"Is this the junior engineers' clubhouse?" *Marvin A. Kunde, Sigma Nu House, Golden, Colo.*

"Monthly Mining Rays." *Charles H. Parr, Mining Engineer, Sacramento, Calif.*

"Monthly Mining Informant." *Peggy Parr, Sacramento, Calif.*

"Hmmmmm. Another cavity!!" *J. W. Keim, Warren, Ariz.*

"With his eyes open, he stuck his neck out and put his foot in it." *With apologies, Joel H. Watkins, Charlotte C.H., Va.*

"Manicure, Please." *Geo. C. Bartholomees, E.M., Bonne Terre, Mo.*

"But, DEAR, I WAS working late at the office!" *Harvey C. Smith, General Electric Co., Schenectady, N. Y.*

"My—Teeth like Eleanor's." *Anonymous, West Mince Pie, Nebr.*

"Gad—this takes a bite like the new income tax." . . . or . . . "Secretary Snyder got his income tax ideas from this." *John A. Grover, Schenectady, N. Y.*

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less resistance than mica) with a specific gravity of 5.4. Besides the formation of N and P-type crystals, germanium has another strange electrical property: Resistance increases with heat until it reaches 165°C, but then it decreases (just the reverse of usual conductors). The metal is not highly active—the oxide can be reduced with either carbon or hydrogen.

Metallurgical technique is a major factor in the making of transistors. Control of the amount of trace impurity in N and P crystals is vital—and the amount is so minor that it can be introduced by transmutation under a cyclotron. The new trick—the one which led to the junction transistor and the power rectifier—is production of a crystal at a time by withdrawing it from a nearly freezing bath of molten germanium. The result is a quality control that could not be achieved economically by other methods.

How much germanium will be required? Some authorities estimate that we will use at least five times as much germanium in 1956 as we used in 1951. Manufacture of 100-million amplifying transistors in 1956 might require 20,000 lb. of germanium metal. Actually, the greatest use will be in rectifiers which will probably use twice as much germanium in a given year. All in all, the transistor industry may require 20,000 to 40,000 lb. of germanium in the year 1956. The price of germanium is currently $180 per lb. Little of it gets on the market as pure germanium—electronic companies prefer to make their own from the oxide.

Where will it come from? Eagle Picher Co. in the Tri-State district is the dominant producer; the company earned that position through the research efforts of Chief Physicist Dr. John Musgrave, who made germanium at a time when it was merely a curiosity. The zinc-sulphide in Tri-State ores contains 0.01 to 0.10% Ge, and according to 1949 Minerals Yearbook, the estimated zinc reserves would contain 240 to 2,400 tons of germanium metal.

Germanium occurs in fairly large quantities in two minerals: Germanite ($7CuS.FeS.GeS_2$) is a dark reddish-gray mineral that contains about 8.7% Ge; a notable occurrence of germanite was at the Tsumeb mine, in copper-zinc-lead sulphides. Argyrodite ($4Ag_2S.GeS_2$) is a steel gray mineral usually associated with siderite, marcasite, less often with sphalerite and galena; it contains about 6 to 7% Ge.

Germanium, in small quantities is common in coals. British investigators have found that flue dusts from the high chimneys of producer-gas systems contain about 0.75% Ge, investigators have stated that from boiler and producer dusts, Great Britain could produce 2,000 annual tons of germanium.

Price will make little difference to electrical manufacturers. Even at $180 per lb., the amount of germanium in a transistor is worth less than a nickel. The important thing is assurance of supply

Here's the outlook on these germanium units: A recent sampling of scientific opinion in the electronics industry shows that the transistor and rectifier are "here." We are on the verge of an era of their widespread use. In his article in the *Scientific American*, Ridenour says, "Even at present early stage of transistor development it seems certain that transistors will replace vacuum tubes in almost every application." And in the opinion of another sober, conservative scientist, Dr. Robert M.

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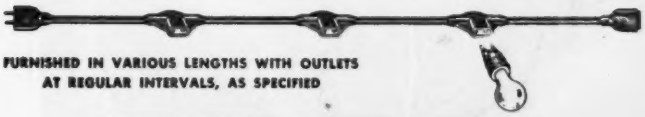
JOY String-a-lite®

DURABLE • TROUBLEFREE • FOOLPROOF

Joy String-a-lite lines are of one-piece molded Neoprene construction—watertight, shatterproof, and age-resistant.

Oils, acids, alkalies or moisture have little effect on their life span or conducting efficiency.

Combinations can be easily installed, moved or varied, by untrained personnel, to fit the requirements of any mine lighting job.



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EHS LAMP OUTLET

Snug fitting Neoprene lip at bulb neck seals out water, dirt and oil.

FSC SIDE OUTLET

Accommodates ERS "Plug-in" Socket or Hand Extension Lamps.

ERS PLUG-IN SOCKET

Converts FSC Side Outlet to Weather-Sealed light socket.

VEIS VAPOR-PROOF LIGHT

Has glass globe with sturdy metal guard, for protecting light bulb. 100 watt size.

SAFE POWER CONNECTIONS

241FR FEMALE RECEPTACLE

A power outlet, consisting of Neoprene insert in sturdy metal housing. No. LFR—same as above except with insert for engaging hand extension lights below.

AHDED EXTENSION

100' of Neoprene covered cord with 241M Male and 241F Female Connectors, factory molded on ends.

241F POWER LEAD

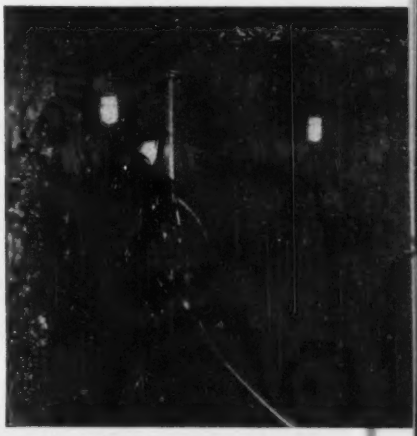
Female Connector on cable length specified by customer. Other end open for wiring into power source.

HAND EXTENSION LIGHTS

Choice of Weather-proof or Vapor-proof lamp styles molded to Neoprene covered cord with LMC Male end Connector. Accommodates up to 100-watt standard Edison based bulbs.

Cord Length	1—Vapor-proof	2—Weather-proof
25'	V5A	W5A
50'	V6A	W6A

JOY String-a-Lite installations at Chief Consolidated Mining Company, Eureka, Utah.



ABOVE—Photo illustrates convenience and safety of JOY Vapor-proof Lights in exceptionally wet working areas.

ABOVE—JOY VEIS Vaporproof String-a-lite illuminating an important haulage-way.

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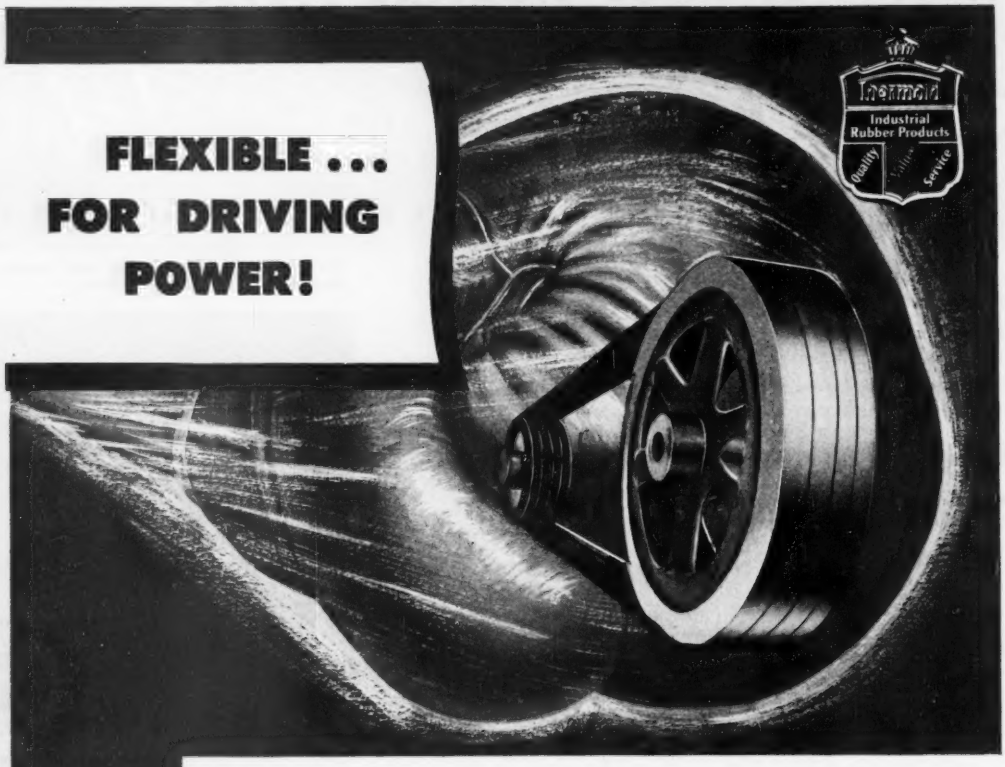

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HOW TO HELP BRITAIN ...and Ourselves

The purpose of this editorial is to help Winston Churchill obtain the aid Britain needs

(1) to weather her present financial crisis, and

(2) to avoid a chronic recurrence of such crises.

This is not a philanthropic purpose.

Britain is our staunchest ally in the free world's continuing fight for survival. She cannot perform her role effectively if she is broke, or if she careens from one financial crisis to another.

Then, too, a nation such as ours—committed to private enterprise as a way of economic life—has a special interest in helping Winston Churchill to help Britain. His administration is relatively friendly toward private enterprise. Should he fail, he would be replaced promptly by a Socialist government more hostile than ever. And that would weaken the standing of private enterprise in the free world.

Cause of the Crisis

It is the drive of the Western World under our leadership to rearm against Russian aggression that has precipitated Britain's financial crisis. It set off a scramble for raw materials from which armaments could be made, and for many other materials that might be short in the event of war. So the prices of the things that Britain must import—mostly raw materials—have been boosted more than the prices of things she can export—mostly finished products. That leaves Britain short of funds to pay for essential imports. This difficulty increases as the necessity becomes more urgent to divert industrial effort from production for export to production for security.

The Basic Trouble

Although Britain's immediate crisis was touched off by the rearmament drive of the Western World, her basic affliction is one from which she has suffered since the end of World War II. Stated in its simplest terms, Britain does not produce enough goods to pay her own way as one of the family of free nations.

For years this deficiency in home production was made up by income from shipping and overseas investment. But Britain had to sell a large part of her foreign investments to finance her heroic part in World War II. So her income from that source has been greatly reduced. And, in spite of an increase of about a third above prewar in her own production of goods and—thanks to a continued "austerity" program—a much larger increase in her exports, Britain still is not paying her own way.

Two Ways to Solvency

Britain has two ways to restore her solvency. One is to cut down on what is consumed—the belt-tightening process. The other is to step up British production.

To surmount the present crisis, Mr. Churchill has asked for some cutting down. He probably must ask for more.

Except as a stop-gap expedient, however, more cutting down of Britain's consumption is clearly a dangerous course. That would further depress a British standard of living which, not more than half as high as ours, already is too low. Politically such a course would grease the skids for Winston Churchill's administration, even now governing by a wafer-thin parliamentary margin. Also, as *The* (London) *Economist* remarks, the "lazy expedient of cutting trade" would result in "hurting other people and forcing them to take similar action"—by cutting the market for their products.

The Only Cure

The best and, in fact, the only way to help cure Britain's economic ills is to help Britain produce more. Here the technical possibilities are encouraging. On the average, the British industrial worker produces only about 40 percent as much a year as the American worker. That is a British estimate, made by Sir Ewart Smith.

Wider use of better industrial methods and modern tools and an infusion of the competitive incentive into British industry — to replace the cartel and other restrictive practices — would go a long way to narrow this wide gap in worker productivity. This is the consensus of experts on both sides of the Atlantic.

Since 1948 the Anglo-American Council on Productivity has done much to encourage output per man-hour in Britain and to foster this doctrine with both labor and management. But much yet remains to be done.

In the United States it is increasingly suggested that before we give Britain any more economic aid we should insist that everything possible be done to exploit the technical possibilities of increased production. This emphasis on production is needed. But if we Americans were to impose upon the hard-pressed British people conditions that could be construed as an affront to a friendly and sovereign nation, we might well put into the hands of a masterful rabble-rouser such as Aneurin Bevan, the anti-American leader of the Labor Party's left wing, a campaign issue on which to maneuver himself into the Prime Ministership.

Churchill Can Insist

But Winston Churchill is not so handicapped as we should be in imposing prerequisites of further aid. As Britain's own, most honored leader he will raise no touchy questions as to Anglo-American relations if he insists that Britain have firm plans to cure her economic ills, plans sharply focussed on ways and means of increasing Britain's industrial efficiency.

By presenting a convincing plan to cure Britain's recurring crises through greater production, Mr. Churchill will greatly facilitate the process of getting the aid his country must have. He will also remove an increasingly dangerous element of dissension in Anglo-American relations — the feeling of many Americans that more aid to Britain is more money down the drain. The way to counter that feeling is to come up with a prescription for an economic cure, not a request for another economic poultice.

Technically, such a program is entirely feasible. It will perhaps be the supreme test of Winston Churchill's statesmanship to make it politically feasible as well.

In the interest of Britain, of the United States and of the whole free world, we wish him all success.

McGraw-Hill Publishing Company, Inc.

International Gold Price Points to Peace

The low 1951 high in gold on Pick's chart (above) shows that, despite Korea, people of the free world have faith in peace.

1946: Wide fluctuation in the selling price of gold shows mainly a lack of faith in postwar governments.

1947: The narrowing gap indicates a return of faith.

1949: The wide gap reflects people's lack of faith, more in their government's currency, than in their government itself

1951: The narrowing gap (low peak in gold prices and low average price) indicates a return of faith in currency, and government—and thus in continued peace.

Burns, chemical director of Bell Laboratories, a new electronics industry based on the transistor "will become the only rival in size of the chemical industry . . ."

Kelley Says U. S. Will Soon Have More Copper

Cornelius F. Kelley, chairman of Anaconda's board, assured copper users that shortages will ease in mid-1952, and predicted an additional 13,000 monthly tons in 1956.

"Repeatedly during the past year, responsible mobilization officials have conducted a systematic campaign that practically amounted to propaganda urging the substitution of aluminum for copper.

". . . while undoubtedly copper is in critically short supply today . . . the copper supply will begin to improve materially during the latter half of 1952."

Today, the total present supply is in the neighborhood of 125,000 tons per month. Here's Mr. Kelley's outlook for the future:

"The first major increase in production will come from Anaconda, via the Greater Butte Project and the new sulphide plant at Chuquicamata, Chile, both of which will begin operations in the spring of 1952. During 1953 the additional production obtained from these two projects over and above present levels should total about 95,000 tons. By the end of 1953 Anaconda's new Yerington project should be producing at an annual rate of 30,000 tons. By then Anaconda will have added to the present yearly copper supply at the rate of approximately 125,000 tons.

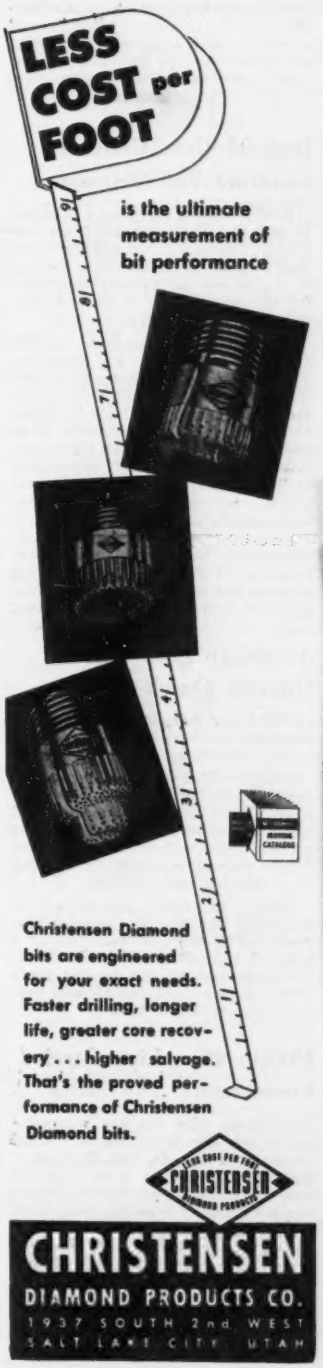
"Other projects now under way, both in the United States and friendly foreign countries, should yield additional copper at an annual rate of approximately 80,000 tons by the beginning of 1954, at which time copper production should be approximately 205,000 tons per year above present levels.

"Projects already under way or contemplated in the United States and abroad should further augment world supply by an additional 240,000 tons beginning in 1955-56.

"All told, we estimate that by 1956 the monthly supply of copper available in the United States could reach 150,000 tons (U. S. production plus imports). Based on historical comparisons, this supply of copper would be sufficient to support a Federal Reserve Board Index of Industrial Production of 270, an increase of 26% above present levels, and 45% above the first half of 1950.

"Thus while copper admittedly is in short supply today, it promises to increase in about the same proportion as expanding steel capacity.

"Anaconda's contribution to the improved copper supply position will be noteworthy. In fact, since the end of World War II, Anaconda has spent or is about to spend a total of ap-



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proximately $300-million in new mining and metallurgical facilities and extensive modernization of brass mills and wire mills. Of this total investment, some $46-million is earmarked for the Kalispell aluminum project."

Bechtel Gets General Contract for Orinoco

Mack C. Lake, president of Orinoco Mining Co., United States Steel subsidiary, announced that a contract had been awarded to Constructora Bechtel, S. A., to act as general contractor for the construction of Orinoco Mining Co.'s Cerro Bolivar project.

Constructora Bechtel, S. A., an affiliate of Bechtel Corp., will supervise, direct, and engineer construction facilities in Venezuela which will include the construction of the mine facilities; a 90-mi. railroad and highway from Cerro Bolivar to the port; and construction of port and ore-loading facilities among which are power plants, material-handling, housing, water-supply and sewer systems. It is expected that some of these facilities will be built by Venezuelan contractors. Construction will proceed at once, and it is expected that shipments of iron ore will begin in 1954.

American Zinc Will Operate Quick Seven

DMPA and American Zinc, Lead & Smelting Co. have signed an agreement for increased production of zinc.

American Zinc will open and operate the Quick Seven lead-zinc mine near Neck City, Mo. The company will spend approximately $700,000 on the project which will include equipment for the open-pit mine and the building of a 1000-ton concentrator.

DMPA, in return, has agreed to buy up to 11,000 tons of the slab zinc produced by the new facilities at a price of 17¢ per lb., f.o.b. St. Louis. The agreement will run for two years after the new facilities go into production sometime in 1952.

INCO's Pipe Line Carries Concentrate 7½ Miles

A 7½-mi. pipe line has been completed by The International Nickel Company of Canada, Ltd. Through it the bulk concentrate from 3,650,000 tons of nickel-copper ore is being pumped annually from its newly built Creighton concentrator to its reduction plants at Copper Cliff. It is believed that never before has concentrate been carried by pipe line in such quantity over such a distance.

In making the announcement R. L. Beattie, vice president and general manager, said: "The pipe line reduces the time required. . . . Further, the economies resulting from pipe-line transportation, together with other economies, have made possible the working of lower-grade Creighton ore."

Part of International Nickel's $130-million program of underground mine expansion, the pipe-line artery is integrated into an elaborate pipe-line system which also carries tailing from both Creighton and Copper Cliff to a disposal area midway between the two plants. The system has 12 mi. of trestle, at some points 65 ft. high (to assure a slope to and from each of the five relay pumping stations so that the concentrate lines will be self-draining in case of power difficulties). All told, 3-million fbm of lumber and 40 mi. of wooden pipe were used.

Milling 10,000 tons of nickel-copper ore a day at Creighton produces approximately 1,800 tons of concentrate and 8,200 tons of tailing. Water added to the concentrate makes a pulp which flows through the pipe line at the rate of 800 gpm. The tailing pulp flows at the rate of 2,500 gpm. Several times the temperature has dropped to 30 deg. below zero with no operating difficulties.

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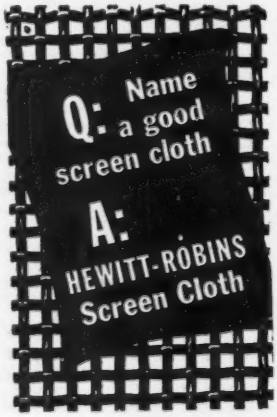

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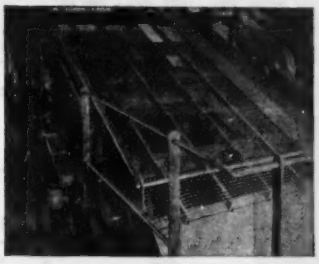

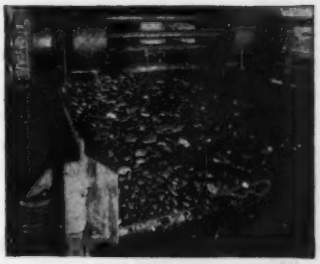

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Reserve and Reynolds Get Write-Off on $196 Million

EARLY IN JANUARY, DPA issued two certificates to Reserve Mining Co. for taconite facilities, and issued five certificates to Reynolds Metals Co. for aluminum facilities. Both companies got five-year write-offs.

Reserve's first certificate allows it to write off 75% of $6,781,000 it is spending at Babbitt, Minn. The second allows a 75% write-off on $105,776,370 it is spending at Beaver Bay, Minn.

Reynolds got five certificates totaling $83,096,300. One allows the company quick write-off of 85% of $42,319,000 it is spending on its Corpus Christi, Tex. plant. A second allows for writing off 85% of $33,492,000 it will spend for a reduction plant in Arkansas.

Simplified greatly, this is what quick write-off means:

Assume that a company which normally amortizes a plant in 20 years receives quick write-off on 75% of $100-million.

With quick write-off, the company is not taxed on (deducts from its before-taxes profit) 1/5 of $75-million plus 1/20 of the remaining $25-million—a total of $16.25-million deducted from each year's profit before taxes.

Without quick write-off the company could only deduct $5-million.

Results would be that the company would save taxes on the $11.25-million difference. Taxed at the minimum 52%, during those first five years the corporation would have an annual net profit $5.85-million greater. But after the fifth year it would pay a higher tax rate than ever.

IN THE UNITED STATES

ALASKA

★**Red Mountain chromite** properties near Seldovia, Alaska, will be made accessible through construction of a 14-mi. road connecting with the present Seldovia road system. Interest in the chromite deposits has been indicated by both the Alaska-Juneau Mining Co. and the United States Vanadium Corp.

★**On Sitkalidak Island,** Peninsula Exploration Co. is working through most of the winter developing the Sitkalidak Contact Copper deposit. Peninsula, principal owner of the nine present claims on the contact structure, was formed by six men from Kodiak Island: H. Neseth, T. von Scheele, Alf Torgramsen, Donald Petacchi, Nels Christiansen, and R. E. Krautter.

The men started their development

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ON THE ROAD OFF THE ROAD

UNITED STATES RUBBER COMPANY

Alaska *(Continued)*

program on Oct. 15 with a view to drifting some 1,200 to 1,400 ft. southwesterly along the contact. Mineralization stays close to the contact, and consists of copper (mainly as chalcopyrite, azurite, and bornite), with some gold and silver. In general the deposit is very irregular: In most places there is gouge on the hanging-wall side (the igneous side of the contact—quartz diorite, granodiorite, and rhyolite); and there is usually 1 or 2 ft. of chalcopyrite assaying up to 16% copper. Extending into the footwall limestone for a distance of several hundred feet, low-grade copper has an assay cutoff. Peninsula intends to continue this season's exploration (weather permitting) until sometime in February, 1952.

ARIZONA

★**The 16 Blue Bird copper claims** 1.5 mi. west of Miami in copper-rich Gila County have been purchased at an indicated price of $1-million. Buyer was W. J. Hacht, Phoenix, former Detroit manufacturer's agent; seller was the estate of the late Frank E. Carrow, Globe. Hacht plans to start work immediately on these claims on which no work has been done since 1910. Lynn Hersey, consulting engineer, will be in charge of drilling.

★**Near Tiger,** a town of 6,000 population is forecast for the San Manuel development. At present population figures, that town would be third largest in Arizona. Through drilling done to date, San Manuel Copper Corp. has drilled up an estimated 463-million tons of 0.78%-copper ore. That tonnage would give the mine a long life, approximately 50 years at a mining rate of 30,000 daily tons.

★**From Johns-Manville Corp.,** Western Products Co. of Los Angeles has purchased idle asbestos claims 30 mi. east of Globe. W. D. Cluff is president and G. W. Johns, secretary of Western.

★**Near Hillside in central western Arizona,** the Old Dick lode mine (a high-grade pockety zinc-lead show) was recently purchased by Mr. and Mrs. F. G. McFarland and Mr. and Mrs. S. R. Hullinger of Toole, Utah. The families also purchased a group of claims from Mrs. Ernest R. Dickie.

★**A new shortage** has confronted operators of copper-leaching plants—the shortage of tin cans. To do its part, the City of Phoenix is thinking of saving tin cans from garbage collections. The cans would then be shredded to be used as copper precipitant.

★**In 1951, Arizona's uranium production rose** to where it is probably larger than any other sector of the west, according to Roger Manning, director of Mineral Resources. The big uranium country is in Apache and Navajo

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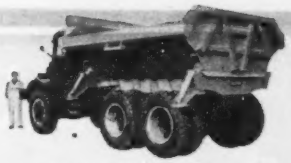

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EASTON SIDE-DUMPS

B-1030

Arizona *(Continued)*

counties—on the Navajo Indian reservation. Manning, who took office in 1951, has added two new men to his staff: Axel Johnson is at Tucson and Mark Gemmil is at Prescott; both operate from local Chamber of Commerce offices. A further service is provided by Frank Tuck who makes a monthly report available to all mining interests; copies are available from the Arizona Department of Mineral Resources, Fairground, Phoenix.

★**William Allison,** president of Allison Steel Co., of Phoenix, has bought the Sheldon lead-zinc mine in Yavapai County and is building a mill to handle slightly more than 100 tons of ore daily.

★**In 1951, Arizona's copper production reached an all-time peak**—842-million lb., which is 13-million more than 1929's previous record and 36-million more than the 1950 figure.

Gold and silver were also up. Gold output rose to 123,000 oz. from 1950's output of 118,313; the cause was increased copper output. Silver rose to 5,340,000 oz. from 1950's 5,325,441 oz.

Zinc and lead slipped. Zinc at 104-million lb. (versus 1950's 120,960,000) was enough to make Arizona the fifth largest zinc state. Lead at 36-million lb. (versus 1950's 52,766,000) put Arizona in fourth place.

In 1950, the total value of gold, silver, copper, lead, and zinc was $201-million as compared to $186-million for all agricultural crops. Mining is still the state's biggest industry, and is holding its own.

Since 1910, the tonnage of ore mined has multiplied 11 times, and at the same time the value per ton has fallen from $10.91 in 1910 to $4.71 in 1950.

★**Production from Artillery Peak** deposits in Mohave County has stopped. A several-thousand-ton shipment of ore—mined during recent exploration and development—is being shipped to Las Vegas, Nev. where an economical way of processing the 14%-manganese ore is sought.

CALIFORNIA

★**Central Eureka** reports development of the new vein, discovered last October on the 3,500 ft. level of its Sutter Creek mine, is progressing with satisfactory results. The company, now milling 150 tons of gold ore daily, has disclosed plans to double capacity of its reduction plant.

★**More than 1,000 employees** of the American Potash & Chemical Co.'s Trona, Calif., works have switched their affiliation from the independent Mine, Mill and Smelter Workers to the catch-all District 50 of John L. Lewis's United Mine Workers. Just before expiration of the labor-management contract Dec. 1, the union local met and voted to disaffiliate from the Mine, Mill and Smelter Workers. About 67%

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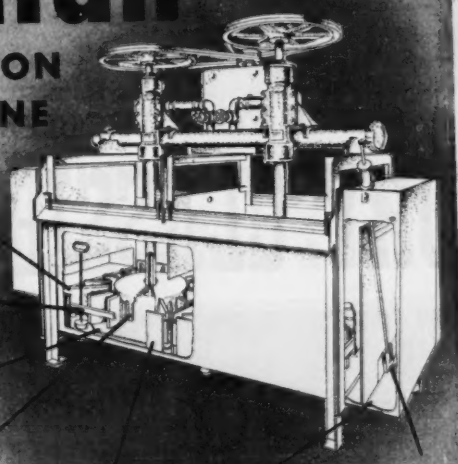

The famed AGITAIR not only gives you efficient, low-cost concentration . . . but it applies its unique method through a machine so ruggedly built, so well guarded at the vulnerable points, that loss of production through shutdowns is all but negligible. For example, there are tough rubber coverings to protect hard-working parts — like impellers, stabilizers and wear pads. Such working parts as impellers and bearing assemblies can be changed if necessary without interrupting the flow of pulp.

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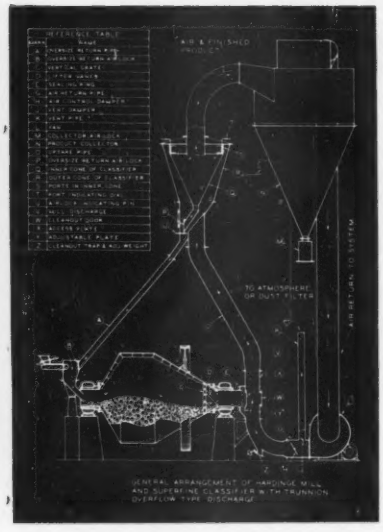
IS YOUR PROBLEM

DRY CLASSIFYING



HARDINGE DRY CLASSIFIERS

The Hardinge Air Classifier, operating in conjunction with the Hardinge Mill, is a compact, self-contained unit of unusual efficiency. The material is conveyed without auxiliary apparatus to any convenient location in the building. The Hardinge "Loop" Classifier delivers products ranging from 50% to 90% minus 200 mesh. The Hardinge "Superfine" Classifier can produce 99½ plus % passing 325 mesh. Bulletin 17-B-1.

Hardinge Ball or Pebble Mills are well suited for ores, ceramics and other fracturable materials.

HARDINGE

See opposite page for Addresses of Branch Offices.

California *(Continued)*

of the employees signed cards indicating their approval of the disaffiliation and their desire to affiliate with the UMW. The company cancelled its contract with Mine, Mill and Smelter Workers, under the five-day notice clause, and negotiated a contract with UMW. The new contract runs for 18 months and provides for an 8¢ an hour wage increase, plus 2¢ more to eliminate plant inequities, and additional fringe benefits that bring the total to approximately 11¢ an hour. The contract is retroactive to Dec. 1.

★**Harlin, Inc.,** which recently bought the Great Northern mine near Yreka in Siskiyou County, is in production. Captain John Harlin bought the mine after Carl Yates had leased it, reopened it, and shown it to be promising. Cinnabar at the Great Northern occurs as flakes and streaks along fracture and parting planes in a schistose rock intruded by granodiorite. Recent exploration and development have disclosed additional reserves. The plant has been equipped with a crusher, concentrator, jig and retorts, and is designed to handle 150 daily tons of ore. (Note that the plant employs concentration prior to retorting.)

★**From near Crescent Mills** in Plumas County, Lakeview Manganese Mines is shipping ore to Geneva Steel Co. in Utah. The mine, a major World War II producer, is reported to contain substantial reserves recently opened by a new tunnel.

★**Near Mountain Pass,** Molybdenum Corporation of America has discovered monazite in one area, and, in another area, barite-free rare earths. Because it feels that either occurrence might be commercially significant, the company is exploring the finds. (The barite-free rare earths are desirable for steel-making, where presence of barite makes "dirty steel.")

COLORADO

★**Lloyd Stoner** recently shipped nine lots of ore to the Carlton mill. Four were from the Free Coinage and five from U. G. M. property. They averaged about $11 per ton.

★**Colorado is getting set** for the 1952 convention and machinery exposition of the American Mining Congress, Sept. 22 to 25 inclusive at Denver. Merrill W. Shoup has been elected chairman of the board of governors of the Western Division.

★**Ed Edwards,** manager of Aztec Mines, reports that with most of the necessary equipment delivered, his company will soon start operation. When the first load of concentrate leaves camp, the company will celebrate by throwing a party and dance.

★**One of Cripple Creek's** most promising leases—and certainly one of the richest in spots—is that of Earl and

John Robush on the Little May tunnel at the El Paso mine. According to Earl Robush, small ore pockets that they have taken out in sacks have assayed as high as $30,000 in gold. The last shipment, totaling 64,340 lb. of mine-run ore, averaged 2.354 oz. of gold, or $82.08 per ton.

★**Silver Bell Mines Co.** recently purchased most of the available lots in Ophir. Starting next spring, the company plans to build a number of new houses for employees at the Silver Bell and Carbonero mines.

★**John Lambertson** recently completed transactions for the sale of 31 lode mining claims to New Jersey Zinc Exploration Co. All 31 claims are in Spring Creek mining district.

★**The Carlton mill** has revamped its crushing setup and now has a jaw crusher and Symons cone in conventional two-stage operation.

★**A recent 1,000-lb. shipment** of high-grade from the Ajax mine ran better than $2 per lb. The ore, from the 28th level, was shipped to the Carlton mill. Charles Carlton, mine manager for Golden Cycle Corp., also disclosed that the company has hit ore on the 30th level of the Ajax, in the Bob Tail vein.

★**Gordon Dean,** chairman of AEC, announced that AEC is now developing tentative plans for a vast new expansion of America's atomic weapons output—third since 1949. Mr. Dean said that the proposed expansion was made possible, in part, by recent discoveries of uranium in Colorado. The rugged San Juan area of southwestern Colorado has become a new uranium-mining center. Most recent discoveries were in the Uncompahgre and Red Mountain districts of the San Juans.

★**At the Carbonate Queen mine** near Elkton, power has been turned on and the hoist and compressor are ready to go.

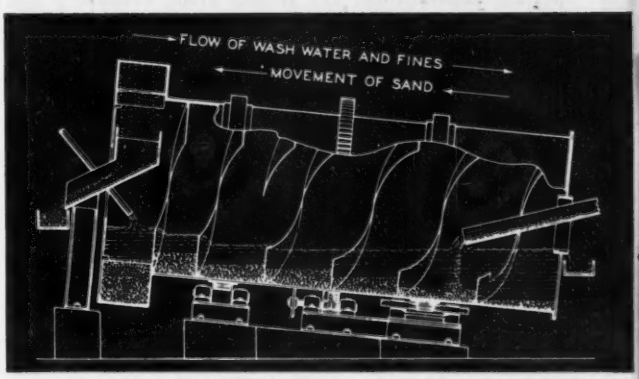
★**From the Strong mine,** Front Range Mines, Inc. recently shipped 21 tons of concentrate to ASARCO's Leadville smelter. Front Range received settlement checks totaling $25,883.61, according to John Deerksen, president of the company. Through recent intensive development, Deerksen has put the mine in a strong productive position.

IDAHO

★**In the last 40 ft. of drifting** on the vein on the 3100-ft. level of Sunshine Consolidated, the commercial ore streak has widened from 1½ to 3 ft., according to Norman Smith, resident engineer and geologist for the company. The ore averages 30 to 40 oz. of silver across the face and provides a mill feed of 15 to 30 oz. The company has recently opened the vein on the 2700-ft. level with a crosscut from Sunshine workings and is producing 1000 tons per month from raise

IS YOUR PROBLEM

WET CLASSIFYING



HARDINGE WET CLASSIFIERS

Counter-Current Classifier built by Hardinge produces closer sizing and cleaner oversize because of its unique construction. It consists of a slowly rotating drum, on the inner surface of which is attached a screw flight. The coarse material is separated from the fines through the action of gravity. The settled granular particles are rolled forward by the screw flight and washed with a counter-flow of wash water. The fines and wash water overflow through an opening at the discharge end. The oversize is elevated by buckets in the enlarged portion and discharged. Will operate in closed circuit with a grinding mill without the use of conveyors or pumps. Bulletin 39-B-1.

Hydro-Classifier built by Hardinge is a large-volume classifier for fine separating problems. In combination with the Counter-Current Classifier, it provides positive control of sizing and moisture. Bulletin 39-B-1.

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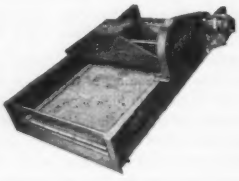
FOR SCREENING ECONOMY

The Leahy Vibrating Screen possesses an uncanny ability to do a job right—and in record time. It screens wet or dry, using screen cloth or perforated plate. Excellent for fine mesh screening, dewatering or desanding. Range from finest mesh up to 2". Ask for Bulletin 15-J.



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Idaho *(Continued)*

work which will connect the 3100 and 2700-ft. levels. On the 2700, the company is drifting westerly on the vein in a good showing of ore.

★**Bradley Mining Co.** has won a damage suit for $21,117 brought against it by the Federal Government. Judge Chase A. Clark of Boise directed the jury to return a verdict in favor of the defendent, Bradley. He told the jury that the government had failed to prove negligence on the part of the company in a fire on a mining claim—a fire that later spread to timber in Challis national forest.

★**Fourteen mining companies** in the Coeur d'Alene district paid their stockholders a total of $8,495,719 in dividends during 1951; that compares with $6,789,289 for 1950. Peak year for the district was in 1937 when the mines paid a record dividend of $8,513,116, only slightly more than in 1951. During the 14 years from 1937 to 1951, miners' wages have more than doubled—they've gone from $6.25 per 8-hour shift to $13.54 per shift. Recently increasing production in the district can be attributed to high metal prices, increased efficiency of mining, and the advent of new mines. Among the new new producing mines are Lucky Friday at Mullan, and the Sidney, Spokane-Idaho, and Sunset in the Pine Creek area.

★**Hypotheek Mining Co.** is preparing to furnish the Amy-Matchless mill on Pine Creek with 50 tons of custom ore per day from a surface discovery made on claims recently purchased from King of Pine Creek. The company, drifting on a vein found by extending an old surface prospect tunnel, has now stockpiled about 1200 tons of ore which assays 2.5 oz. silver, 8.4% lead and 7.1% zinc. If the oreshoot continues for any considerable length, the company will start stoping on this level.

★**On Pine Creek, Nabob Mining Co.** has started crosscutting north from its Crystolite vein to open the Westerly extension of the Nabob structure where a diamond drill hold disclosed about 8-ft. of sub-commercial ore. And on the east side of Nabob's deep crosscut tunnel, another crosscut will be driven to open the Little Pittsburgh vein where diamond drills have opened a highly mineralized area 11-ft. wide. The company also will raise from the lower tunnel to the upper Nabob workings, where leasers are currently mining a large tonnage of lead-zinc ore which is being treated in the Nabob mill.

★**Fred Baumhoff**, Centerville, Idaho, dredge operator, plans to install a million-dollar dredge capable of digging to a depth of 100-ft. for the purpose of producing from deep deposits of monazite gravel near Cascade, Idaho. Baumhoff-Marshall now has a dredge of smaller capacity operating at Cascade and has shipped 1000 tons of monazite to Lindsay Light & Chemi-

cal Co. of West Chicago, Ill. Mr. Charles R. Lindsay III, talking to Baumhoff in December, urged him to increase production of monazite. He said if the Idaho supply is shut off "it would virtually put the industry out of business." He said the Idaho deposits exceed those in Brazil and India, which countries have curtailed exports of the mineral in recent years. Monazite is vitally needed for production of jet engines, and other defense items.

★**Highland Surprize** is currently producing about 100 daily tons of ore, according to superintendent Robert D. O'Brien. Most of it is coming from stopes above the 1,450 and 1,300-ft. levels.

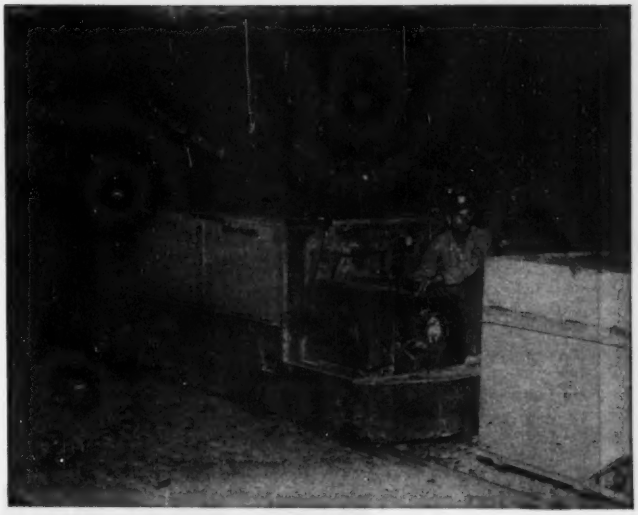
★**M. E. Volin**, chief of the U. S. Northwest Mining Division, reports that the northwest, including Idaho, Montana and Wyoming, contains vast deposits of titanium dioxide associated with magnetite. The Bureau has investigated a deposit on Hoodoo Creek in Idaho County, Idaho, which is estimated to contain about 4-million cu. yd. of placer gravel containing 2¾% TiO_2. A deposit in Teton County, Mont., is estimated to contain 4.5-million tons averaging 6% TiO_2; and another deposit in Broadwater County, Mont., tonnage unestimated, assayed 9% TiO_2. The largest deposit investigated, Volin said, was in Wyoming, 46 mi. north of Cheyenne at a place called Iron Mountain; this deposit was estimated to contain more than 5-million tons assaying 17½% TiO_2 and 44% iron.

The Bureau is experimenting with processes to recover both the titanium dioxide and iron, and several new companies have been encouraged to enter the field.

★**A. E. Weissenborn**, executive official in charge of the Spokane office of DMEA, says the Bureau has financed 66 mining projects in the northwest since its organization. These projects call for the expenditure of $3,268,390, the government's portion of which is $1,831,657. Idaho tops the list with 26 projects; Montana, 25; Washington, 13; Oregon, 2. Thirty-seven of the projects are for lead-zinc ore, 10 for tungsten, 7 for copper, 5 for antimony, 2 for manganese, 2 for uranium and one each for uranium, fluorine and thorium.

★**According to official records** in the County Recorder's office, 550 new mining claims, covering 11,000 acres of virgin mineral ground, were located in the Coeur d'Alene district in 1951. About 300 of the new locations were in the Hunter mining district, surrounding and east of Mullan, where Hecla, Day, Coronado, Federal, and Sullivan are particularly active.

★**U. S. Bureau of Mines** statistics for 1950 list Idaho as the leading producer of silver in the United States, first in tungsten and second in lead and zinc. The State produced, according to the Bureau, 28% of the nation's lead,



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However, their non-critical charge characteristics are only one of their advantages. They are *durable mechanically:* grids, containers and other structural parts of the cells are of steel. The alkaline electrolyte is a recognized preservative of steel. They are *foolproof electrically:* they are not injured by short-circuiting, reverse-charging or similar accidents. They *withstand temperature extremes:* they are not injured by freezing at any state of charge because the density of the electrolyte does not vary appreciably with the state of charge; they are easily ventilated for rapid cooling. They can *stand idle indefinitely* without injury: they are merely discharged, short-circuited, and stored in a clean, dry place.

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Idaho *(Continued)*

36% of the zinc, 21% of the silver, 4% of the gold, and 1% of the copper. The report showed 155 producing mines in the state as compared to 171 in 1949. The Coeur d'Alene district accounted for 95% of the State's silver output.

LOUISIANA

★**The first "amphibious" mining plant** in the history of the sulphur industry will be put into operation in 1952. Designed for marshy Bay Ste. Elaine along the storm-swept Louisiana Gulf Coast, the plant is being constructed on barges at Freeport Sulphur Co.'s Grande Ecaille, La., mine. When completed, it will be floated 75 mi. to Bay Ste. Elaine. The barge-based units will be anchored over a marsh-covered salt dome for mining brimstone.

MICHIGAN

★**Announcement** that RFC had approved $57-million for White Pine, revitalized the little ghost village of White Pine and also the larger town of Ontonagon, 20 mi. northeast of White Pine. Preliminary work has already started, and full-scale construction will start about the middle of April. Turner Construction Co., New York, has the general contract; R. C. Wilson, chairman, and C. N. Hernandez will be active for Turner. Western-Knapp, Stone & Webster, and Pace Associates will assist in their various specialties.

★**Calumet & Hecla** has started preliminary mining through its Caledonia adit in Ontonagon County. According to company officials, a thorough investigation will be made to determine whether or not a sustained operation is possible. The company expects to mine about 200 daily tons during exploration, and will send it to the company's mill at Hubbell. The Caledonia is in one of the areas where white men first mined Michigan's copper. C&H first explored the area in 1937. Of the number of lodes in the district, the Caledonia is on the Knowlton lode which is considered one of the most promising.

★**Gillie Le Vernois,** 88-year-old pioneer and prospector who lives in a small cabin on the Brule River 3 mi. northwest of Florence, Wis., says he has assayer's reports to show that natural caves on his property contain manganese ore running 37%.

★**Inland Steel Co.** has a full program planned for the winter months: Shaft sinking will be continued at the new Cayia mine on the Menominee range; and the Morris mine shaft on the Marquette range will be deepened.

★**According to the County Mine Inspector's reports,** the Richmond mine of the M. A. Hanna Co. is the only

mine in Marquette County that has never had a fatal accident. The last lost-time accident occurred in April, 1948. The Richmond is an open pit operation with a hard, siliceous-ore. It has shipped over 3½-million tons up to the 1951 season.

★**Iron River district mines** are now stockpiling ore after having filled the final cargoes of a big 1951 season. The C&NW reported that an all-time record of 6,542,335 tons were loaded from the two Escanaba docks during the 1951 shipping season. Of this amount, 4,570,853 tons came from the Menominee Range; 1,631,019 tons from the Gogebic Range (which formerly shipped its ore to the Ashland, Wis. docks) and 340,463 tons from the Marquette Range. This year's shipments exceeded 1950's by 1,535,114 tons and were 286,975 tons more than the 1942 record figure which did not, however, include ore from the Gogebic. The 1951 season at Escanaba ran from April 1 to Dec. 6. The last boat for ore was the Ernest T. Weir of the Hanna fleet.

MINNESOTA

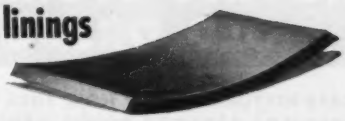
★**Iron ore shipments** from the Lake Superior ranges in the 1951 season totaled 89,092,012 gross tons, according to the Lake Superior Iron Ore Association. Comprised in this total are 86,962,490 gross tons shipped from United States ports, including Escanaba, Marquette, Ashland, Superior, Duluth and Two Harbors; also 804,173 gross tons, shipped from Michipicoten, Ont., by the Algoma Iron Ore Properties, and 1,325,349 gross tons shipped from Port Arthur, Ont., by Steep Rock Iron Mines Ltd. The grand total represents an increase of 13.92% over the corresponding figures for the 1950 season.

★**National Steel Corp.** has sold its 15% interest in Reserve Mining Co. to the two remaining owners, Armco and Republic. Now those two own Reserve on a 50-50 basis. Reason for National Steel selling is that it is not in any particular need for iron ore with its supply assured by Hanna ownership in National. Armco and Republic need assurance of ore for the future, and are using Reserve as part of that assurance. National, with the time coming when big money must be invested in Reserve, has evidently decided to invest elsewhere; for instance, National is already committed to a large expenditure for its part in Iron Ore Company of Canada.

★**Inter-State Iron Co.** is preparing the Wentworth mine, 7 mi. east of Aurora, for shipping in 1952. Stripping is in progress, with seven trucks hauling to the dump. Work is under way on a screening, crushing and washing plant. Paul Kruse is superintendent at the mine. Approximately 70 men will be employed.

★**DPA has granted certificates of necessity** (which authorize the write-off

Lengthen the life of your mill linings with



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UNITED STATES STEEL

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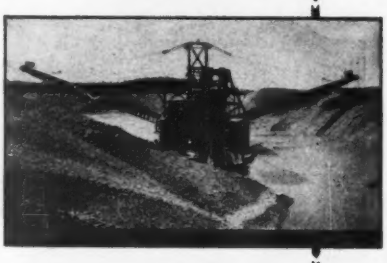
TWO CASE HISTORIES SHOW HOW YUBA REDESIGNS AND REBUILDS DREDGES TO FIT NEW GROUND, CHANGED CONDITIONS AND NEW OPERATING AIMS.

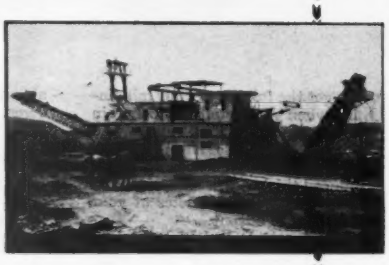
CONSTRUCTS DIVERSION CHANNEL

YCGF No. 16, built by YUBA in 1916 with 18 cu. ft. buckets and 77 ft. digging depth, later was equipped with two stacker ladders to pile tailings in parallel rows about 500 ft. apart, forming diversion channels for flood control while dredging alluvial gravel. In 1930, YCGF No. 16 was redesigned, moved to Folsom, Calif. and rebuilt as Capital No. 3 for 62½ ft. digging depth.



REBUILT 3 TIMES

Capital No. 2 (later Biggs No. 2), built in 1906 as YCGF No. 3, has been redesigned and rebuilt 3 times and used in three different areas with digging depths changed as needed from 60 feet to 50 feet, then to 47 feet below water. Bucket speed was increased from 18.6 to 22.8 feet per minute; bucket capacity increased from 7 to 9 cu. ft., and daily average running time upped from 18.3 to 22.1 hours.



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Minnesota *(Continued)*

of 50% to 65% of expansion cost over a five-year period) to 15 Lake Superior mining companies. The largest write-off was to Inter-State Iron Co. for operations at Buhl, Calumet and Itasca County, with a total of $2,401,-861. Other companies that were allowed write-offs include the Cleveland Cliffs Iron Co.; Oliver Iron Mining Co.; Hanna Ore Mining Co. and Republic Steel Corp.

★**Work on the Heavy-Media plant at** M. A. Hanna's Mesabi Chief mine near Keewatin is progressing rapidly. The plant is expected to be ready by May 1 for the 1952 season.

★**During the winter,** Inland Steel Co. will be sinking shaft and stripping at its Armour No. 1 and No. 2 on the Cuyuna Range.

★**Inter-State has completed** operations at the Grant mine at Buhl and is dismantling the equipment to be shipped to other Inter-State mines such as the Wentworth and Schley-Pettit. Nearly 11 million tons of ore have been shipped from the Grant.

★**These M. A. Hanna Co.** Minnesota mines plan to move an estimated 17-million cu. yd. of stripping during the winter season: Mesabi Chief, Buckeye, Galbraith, Patrick, Harrison, Perry-Wyman, Carlz, Section 18, Morton, South Agnew, Weggum and Douglas mines on the Mesabi Range; and the Mallen, Section 6, Louise and Portsmouth on the Cuyuna Range.

Shop and surface buildings are under construction at the Enterprise mine, north of Virginia, where stripping will be started next spring. The Enterprise is a new mine with an estimated tonnage of about 5-million tons.

★**On Dec. 19,** E. V. Willard, deputy commissioner of conservation, presided in Virginia at a hearing on the application of the Oliver Iron Mining Co. for a permit to use 1,000 gpm of runoff water from a part of the West Two Rivers watershed, the water to be used for the taconite pilot plant north of Mt. Iron now under construction. L. J. Severson, general mining engineer from Oliver's Duluth office, said: **"We estimate this plant will have a normal capacity of approximately 500,000 tons of taconite concentrates per year—and approximately 2-million tons of crude taconite may have to be treated to produce this amount . . . [and] that water in the amount of 1200 gpm will be required to operate the plant."**

★**Oliver Iron Mining Co.** is building at Virginia what is probably the first diesel locomotive repair shop on the Mesabi Range. It will service all Oliver diesel-powered equipment for the eastern district.

★**In a talk at the Dec. 12** meeting of the Engineers' Club of Northern Minnesota, R. W. Bell, assistant superintendent of Erie Mining Co.,

gave a talk on jet piercing. The present limit of drilling is about 31 ft.; but a machine now being constructed will make holes as deep as 47 ft.; The holes average 9.93 in. in diameter and can be chambered at depth for loading explosives, much as holes are sprung in softer material.

★Zontelli Bros., Inc., has taken over Pacific Isle Mining Co.'s lease on the Gorman mine at Randall, and is dewatering the mine in preparation for mining and stockpiling a small amount of ore this winter.

MONTANA

★Domestic Manganese & Development Co. is scheduled to receive funds from the Government early in 1952 to operate its pink manganese concentrator and nodulizing plant in the southern part of Butte; John H. Cole, Butte, is president and general manager. The Government already is buying such ores from Philipsburg and stockpiling same at the Domestic plant. Mitchell Mining Co., a new operation in Butte, shipped a truckload of pink manganese to the Domestic stockpile on Nov. 26, 1951, from its Margaret Ann claim in the northern part of Butte and expects to make further shipments steadily. Government loans, it is expected, will be received shortly (to produce rather large tonnages of manganese) by I. G. Irving, Butte, who expects to operate the Norwich claim in the western part of Butte; and W. McC. White of Butte Mines Merger Corp., who expects to operate the Minnie Jane properties a short distance west of Montana School of Mines. P. Antonioli is ready to begin shipping from his pink manganese producing properties in the western portion of Butte and Philipsburg as quickly as he gets his government loan.

★Canyon Lode Mining Co., Spokane, Wash., has taken over the famous Cable mine in the Georgetown Mining District, 15 mi. west of Anaconda. The mine was purchased from the H. C. Bacorn Estate. (Mr. Bacorn was for some years before his death a vice president of the Mining Association of Montana.) The Cable mine was one of the outstanding gold producers in Montana before the turn of this century, when it was operated by the Savery family. A nugget from the mine exhibited at the 1876 Exposition in Philadelphia is said to have been sold for over $10,000. R. R. Wallace, Spokane, is president and manager of the new company.

NEVADA

★Pacific Butte Mines Co. is preparing to process 100 tons of tungsten ore daily at the Consolidated Virginia mill at Virginia City. The company has just completed remodeling the mill, in order to treat ores from the MGL

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Nevada *(Continued)*

mine at Pyramid Lake, and custom ores from nearby mines. Hugh F. Cameron, Los Angeles, is president of the company in charge of the mill work. A Kue-Ken crusher has been installed with a rated capacity of 18 tons per hour through a ⅝-in. screen. Also installed are jigs to handle the ore before and after it passes through the ball mill in closed circuit, as well as tables and classifier.

★**Controlling interest in the Nyco Fluorspar mine** in eastern Nye County has been purchased by the H. W. Gould & Co., San Francisco, and an extensive development program has been mapped. The company has agreed to finance a 100-ft. raise and an additional 400 ft. of drifting. The present tunnel on the vein is in 125 ft. The vein varies from about 4 to 5 ft. in width and contains a good grade of fluorspar. Samples are running as high as 92.67 CaF_2. Future plans include construction of a mill to concentrate 75 daily tons of ore to 98% CaF_2. Details of the development program were worked out by M. H. (Mike) Gould, D. W. Terrell, S. C. Terrell, and S. W. Terrell, majority owners of the property

★**H. W. Gould & Co.** also plans to construct a 250-ton mill at the Baxter fluorspar property near Broken Hills in Mineral County. The company acquired control of the Baxter mine last spring, and is carrying on an active development program there.

★**Silver ore that is reported to average $40** per ton is being mined at the Mohawk in Esmeralda County. E. R. Hines, owner of the property, reports that his miners have been drifting on the ore for nearly 200 ft. and carrying it 8 ft. wide, with no wall as yet in sight. Hines obtained control of the Mohawk property early in 1951 and carried out an extensive development program before making the silver strike.

★**Jumbo mine** in the Awakening district of Humboldt County is producing an average of 1,000 tons of gold ore daily. During the last two years mining and milling equipment costing a total of $500,000 have been installed at the property, and the Jumbo is now Nevada's second largest lode gold producer, surpassed only by Getchell. Shoots and seams of high-grade ore are often found in the deposit. Enough ore is reported exposed and indicated to assure capacity operation of the mill for many years.

★**Dutch Flats Mines, Inc.,** is beginning development of 19 lode claims and two placer claims in Idaho Gulch, about 29 mi. from Winnemucca. The new development stems from reported uncovering of a 2,100 ft. long vein of cinnabar. The claims were once worked as gold producers, and also produced some 30,000 lb. of mercury during World War II. Heavy sands recovered were found to contain

scheelite, cinnabar and magnetite with gold values. Although the concentrate is reported not salable in present form, the Salt Lake City group has given a lease on its placer properties to Heber W. Glenn of Salt Lake City who plans to use a new separation method.

Company officials report development plans for the cinnabar deposit include sinking an inclined shaft connecting with two older shafts. In applying for a DMA loan, a faulted zone to be reached by the inclined shaft would be explored by drifting 700-ft. north and 500 ft. south, with crosscutting to outline the orebody limits.

Surface samples taken by Nicholas Crawford, consulting engineer, of Tooele, Utah, vary between 0.11% and 0.2% mercury, with underground samples reaching as high as 0.53% mercury. Estimates of ore already located are given at some 2,000 tons of furnace ore. Company officials are listed as T. A. Cowan, president; G. R. Harmon, vice president; G. White, secretary-treasurer, and M. J. Bertoch, director, all from Salt Lake City except Mr. Cowan who is a Winnemucca resident.

★**A newly formed company,** Basic Management, Inc., will purchase the "residual assets" of the Basic Magnesium plant at Henderson from the State of Nevada for about $5-million. Negotiations on the long-debated purchase are expected to be completed by March 1. Western Electrochemical, Titanium Metals, and Combined Metals, who each lease Basic Magnesium facilities, have combined to form Basic Management.

★**Jay A. Carpenter,** Hugh B. Chessher and J. P. Hart, three Reno mining men, have formed the C. & C. Tungsten Mining Corp. and will operate the Linka Tungsten mine east of Austin. The property has several outcroppings exposed along a granite-limestone contact for more than 2,000 ft., and samples have assayed from 0.3 to 1.0% WO_3. The Linka deposits were first discovered in 1941.

★**Gale Peer is mining tungsten ore** on his Contact claim in Lander Co., and shipping it 250 mi. by truck to the U. S. Vanadium mill at Bishop, Calif. He reports the transportation cost at $12.50 per ton. Peer is now working the 57-ft. level of his shaft. A power shovel was used in surface operations until cold weather set in.

NEW MEXICO

★**Total production of New Mexico mines for the fiscal year ending last June 30 was $92,490,895, an increase of $38,520,330 over the previous year,** according to the annual report of state mine inspector, John A. Garcia. Metal production amounted to $52,647,076, reflecting defense demands for copper; the state produced 75,209 tons of metal worth $35,809,525. Zinc production totaled $13,273,709. State potash

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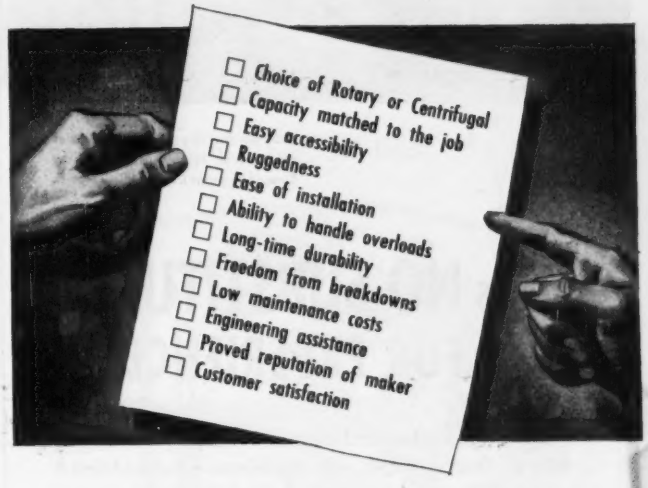
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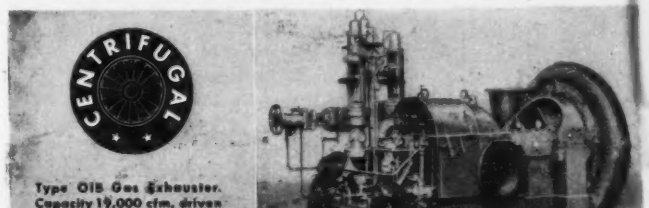

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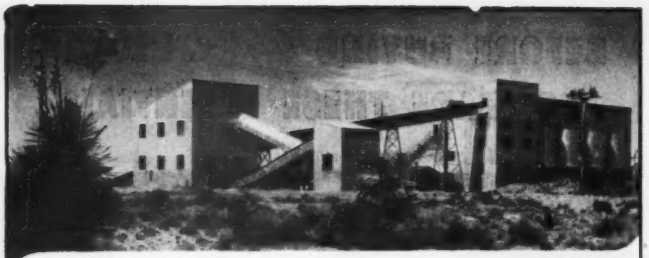

500 ton per day selective lead-zinc concentrator recently completed by Stearns-Roger at Deming, New Mexico

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Construction view of the flotation building with 30'x 20' thickeners in the foreground

New Mexico *(Continued)*

mines produced 6,442,236 tons valued at $32,074,677. Employment in New Mexico mines was 6,325.

★**First shipments** from the recently completed mine of Duval Sulphur & Potash Co., Carlsbad, were made in late November. The company went on its planned schedule of producing 600 tons of muriate of potash weekly. Full production is expected early this year, according to Page Morris, general superintendent. Other management personnel include: J. E. Tong, mine superintendent; G. E. Atwood, refinery superintendent; L. V. Nelson, master mechanic and chief electrician; B. G. Messer, mine engineer; J. W. Borskey, chief chemist; H J. Stevens, chief accountant; J. R. Smith, purchasing agent; John Gasparich, mine general foreman; I. B. Phillips, refinery general foreman; H. A. London, assistant master mechanic; W. H. Parks, mechanical foreman; D. J. Bourne, process engineer and Clifford Ryen, shipping agent.

★**Navajo Uranium Co.**, with headquarters at Cortez, Colo., has erected a new sampling plant at Shiprock, which has been leased to the AEC to purchase the uranium ores produced from the Navajo Reservation, in particular from the Lukachukai Mountains. It is being operated by the American Smelting and Refining Co., ore purchasing agent for the AEC.

NEW YORK

★**Hanna Coal & Ore Co.** closed its Clifton Mines at De Grasse, N. Y., in January, 1952, after having operated the property, both by open-pit and underground methods, for 10 years. Hanna states that the developed ore has been exhausted and reserves are not sufficient to warrant further development. The mine was reopened by Hanna in 1941 after 71 years of idleness.

NORTH CAROLINA

★**Great Western Mining Corp.**, just formed, has gone to work with vigor, plans to open two mines, both in the northern part of McDowell County, near Marion. The first is a vein deposit of copper; ore from it will go to Jersey City, N. J., and Ducktown, Tenn., for smelting, and then will be returned to the mine and processed into copper sulphate. The second mine is being developed at a manganese sulphate deposit approximately 400 ft. by 300 ft. in area and 45 to 60 ft. in depth; the deposit will be pitted, and the ore will be processed in the company's own mill, now under construction. President of Great Western is Dr. T. C. Letellier, and treasurer is George W. Sutton.

★ **Hassett Mining Co.**, of Raleigh, has incorporated for $2,000 to develop mines and mineral lands. Incorporators were J. Vernon Pimm, Ralph Beauchamp, both of Philadelphia, and J. R. Nipper of Raleigh.

★ **At Spruce Pine**, the Minpro plant of United Feldspar & Minerals Corp. was destroyed by fire. The plant was for dry grinding and froth flotation of mica. Edward Scott, treasurer, estimated the loss at $500,000.

OREGON

★ **Bonanza quicksilver mine** has been living up to its name since its reopening last March: It is producing about six daily flasks of quicksilver. On the 500 and 600 levels, new orebodies have been developed.

★ **Two DMEA contracts** finally went to the State of Oregon: In one, the government will lend $26,045 as its share of a $34,727 development of E. E. Stauffer's Coyote group near Brogan. In the second, the government will lend $15,000 toward a $30,000 development of copper at Josephine by Waite Minerals, Inc.

★ **Eastern Oregon Mining & Mineral Association** wants DMPA to establish a manganese ore-purchasing depot at Baker. Producers say that because of high freight rates they can't make a profit on ores mined and shipped to present markets from eastern Oregon.

★ **Ashland Mining Co.** is preparing its gold mill to handle scheelite and chromite ores. The scheelite will come from the nearby Mattern deposit, scheduled to produce soon. The chromite will come from the Shady Cove, Chrome Monument and Rocky Point claims near Galice.

UTAH

★ **Consolidated Uranium Mines, Inc.** is reportedly Utah's largest shipper of uranium ore: Secretary-treasurer C. A. Elggren reports 20,034 dry tons shipped from the Temple Mountain area of Emery County between August 1950 and October 1951. Total gross revenues of $440,678 included $204,367 for uranium oxide, $69,815 for vanadium, and the balance for allowances and bonuses.

Ores shipped by Consolidated Uranium Mines, Inc. and the affiliated Continental Mining & Milling Co. come from leases in the Shinerump conglomerate near Temple Mountain. The firm, with 39 basic claims in the area and contracts with three additional leasers, has been shipping much of its output to the AEC mill at Monticello. However, a new contract signed with Vitro Chemical Co. in Salt Lake City calls for delivery of at least 150 tons per week. And Vitro will reportedly boost its capac-

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Utah *(Continued)*

ity shortly to handle increasing amounts of Consolidated and other ores.

Values in Consolidated's Temple Mt. ore are running about 0.2% U_3O_8. About 12,000 ft. of wagon drilling has been completed with an additional 40,000 ft. of drilling scheduled. New tools capable of drilling well below the present 1,000 ft. limit are on order.

Operating costs are currently $6 to $7 a ton, with sales of 0.2% ore plus allowances averaging some $18 to $20 a ton. Some lenses containing fair amounts of ore and running 100 to 150 ft. in length from a 15-ft. face have been reported recently, but most mining in the conglomerate continues to be carried out in relatively small areas.

★**James Ivers**, vice president and general manager of the Silver King Coalition Mines, has announced that three exploration projects, involving more than 8,600 ft. of drifting, raising, crosscutting and diamond drilling, will be carried out during the next two years in one of the most extensive lead-zinc-silver exploration programs ever scheduled in the Park City district. Much of the work will center around the Thanes area in which the original development of the property began well over a half-century ago. As given by Mr. Ivers, the program includes:

Project No. 1, now under way, will cost an estimated $93,728. An adit is now being driven into the hillside at the level of the collar of the Thanes Shaft. The Comstock Vein will be cut and drifted on for 2,100 ft.; from three crosscuts off the drift, exploratory raises will search for ore. The principal objective is to intersect the Roaring Lion vein, which has a known geologic relation with the Comstock. This work entails 3,418 ft. of drifting, crosscutting, raising and diamond drilling, including the 2,100 ft. of drifting along the Comstock.

Project No. 2 will cost an estimated $89,726. Commencing on the 200-ft. level, 1,000 ft. of diamond drilling, and 2,650 ft. of drifting and raising will be done in an effort to find the intersection of the Comstock and Odin veins. Primary objective is the location of the ore-bearing sectors of the Odin.

Project No. 3 will cost an estimated $138,090. It is divided into two "work problems." First, 500 ft. of drilling and 215 ft. of raising is planned from the 1,100-ft. level up to the 900-ft. level. Work will go into ground now being jointly developed at depth by Silver King and the Park Utah Consolidated Mining Co. Objective will be raising on any extensions of the fissures found productive in deeper levels of Park Utah ground that may extend into Silver King property. Second, crews will drive an entry into Silver King ground at the 900-ft. level with raises to the 850-ft.

level. This will require 700 ft. of work on the 850-ft. level and 550 ft. of work on the 900-ft. level, plus 60 ft. of raises.

The entire $321,000 program is being carried out under a DMPA matching funds program.

WASHINGTON

★ **The Mead magnesium plant** near Spokane, Wash., built by the government during the war at a cost of $16-million, and recently leased by Pacific Northwest Alloys, is ready for full-scale production again after completion of a $2.5-million renovation program. About 750 men now are working in the electrolytic magnesium operation.

★ **American Zinc, Lead & Smelting Co.** has started production from the Lead Hill mine in the Slate Creek area of the Metaline district. The ore is being milled at the Grandview mill. The company holds a lease and option on 17 claims of the Bluebird mine, and has staked 31 adjoining claims. Dale I. Hayes, western manager, says that further active exploration will start in the spring.

★ **Karl W. Jasper,** president of Grandview Mines and Metaline Mining & Leasing Co., says that the two companies will start in May to explore the 10-claim Hidden Treasure group and the 19-claim Bailey-Hanson-Johnson group. Grandview and Metaline hold these properties on lease-option. They are in the Slate Creek area, between American Zinc's Hidden Treasure group and the Canadian border.

★ **Pacnor Mines, Inc.,** an outgrowth of JAT syndicate, has taken over 47 mineral claims and plans to add others. The claims are on Russian Creek, in the Metaline district; they are west of (and adjoining) ground recently located by Day Mines, Inc. Incorporators of Pacnor, which is capitalized at $200,000, include Karl W. Jasper, Graham D. Lammers, and Cline E. Tedrow.

★ **Spokane-Idaho Mining Co.** reports that diamond drilling at the Cleveland mine gave "highly satisfactory" results. One drill hole is reported by Frank N. Marr, president, to be in zinc-lead ore for 66 ft. Another hole, which cut across the area, indicated an ore width of 25 to 30 ft.

★ **Alder Gulch Mining Co.** is reported to have found native copper in three different places. From its mine near Twisp, slabs as thick as a man's hand are said to have been taken from quartz veinlets alongside a dike.

★ **Admiral Consolidated Mining Co.,** operating its Stevens County mine since September has made regular monthly shipments to Trail, and plans to continue them through the winter. Mrs. Richard J. Brown, secretary-

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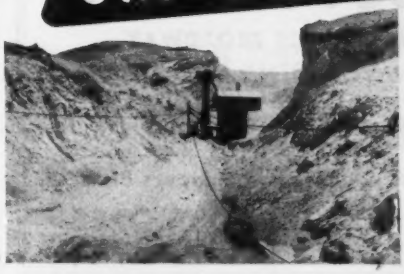

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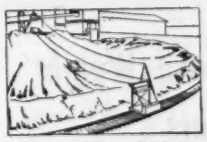
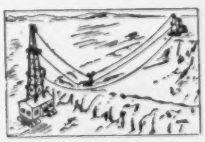
Sauerman Scraper Excavator



Sauerman Scraper Stockpiler

Sauerman Slackline Cableway



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FINDLAY, OHIO

SINCE 1915 — PIONEERS IN HAULAGE EQUIPMENT

Washington *(Continued)*

treasurer, reports shipment returns as follows: October, 56 tons, 61% zinc, $7,727; November, 45 tons, 59% zinc, $6,599.

★ **Richard Munter**, a Spokane attorney, was awarded $3,000 plus $127.17 for expenses in a suit against E. B. Gibbs and Ira Hunley. The fee and expenses were for work done by Munter in connection with the sale of the Bonanza Lead property, which Gibbs and Hunley sold to Anaconda.

★ **Slate Creek Mining Co.** plans to build a new hydroelectric plant for its New Light gold mine in Whatcom County. The present plant will be used as a standby, according to Norman L. Lindsley, Seattle engineer. At 100 tons of daily production, Lindsley estimates that 58¢ per ton will be saved on milling costs, and that it will allow mining of lower-grade ore.

WISCONSIN

★ **In a year-end statement**, president Endicott R. Lovell of Calumet and Hecla Consolidated Copper Co. reported: "Zinc operations improved throughout the year and nearly reached previously estimated capacity. In addition, explorations in the Wisconsin-Illinois zinc-lead district have been successful in discovering increased ore reserves. Presently, these activities are being carried on under a cost-sharing contract with the Government."

IN CANADA

★ **Canada's mineral output** registered another all-time high in 1951. DBS preliminary calculations showed a total of $1,228-million compared with 1950's previous high of $1,045-million. Most impressive gains were recorded by oil (48-million bbls, versus 29-million), zinc (332,000 tons versus 313,000 tons), nickel (137,000 tons versus 123,000), and copper (270,000 tons versus 264,000). Gold is still the most valuable mineral, though production was down slightly at 4.3-million oz. compared with 4.4-million last year. Ontario, continuing to lead all other provinces, produced 35% of the country's total; and Quebec was in second place with 20%.

★ **Cost-aid** for the straight gold mines under the Emergency Gold Mining Assistance Act has been extended for another two years (to the end of 1953) with rates unchanged. Gold mines which wish to take advantage of the world premium market for gold may elect to do so at the first of any quarter; but once having done so must continue on that basis until the end of that calendar year. In so elect-

ing they automatically give up their claim to cost-aid, however, and for that reason only those mines receiving little or no assistance are changing over.

★ **Improvement in Canada's balance of foreign exchange** has led the government to abolish all restrictions on the export or import of Canadian funds. American currency or bills can now be bought or sold freely. Early in January the discount rate on U. S. dollars dropped to just about 1%. More American funds than ever will probably be available for the development of Canadian mining, since invested money and/or profits can be taken across the border at will.

★ **Most Canadian mining interests,** and especially those interested in the iron of Labrador and Quebec, have applauded Ottawa's decision to proceed alone with the St. Lawrence Seaway. Canals to make the St. Lawrence navigable for all but the largest ocean-going vessels will be built on the Canadian side of the river. Cost will be borne by the Dominion Government. The power project awaits an American authority willing to pay one-half the cost of power installations, and will be constructed jointly by Ontario and that partner. About 1.1-million hp. will be available to each partner.

BRITISH COLUMBIA

★ **Giant Mascot Mines Ltd.** will nearly double the capacity of its lead-zinc mill on the Spillimacheen River south of Golden in eastern B. C. Increase in capacity from 170 tons to 300 tons daily was approved at the annual meeting at Vancouver, following recommendation of mining engineer J. E. R. Wood, who was named to the board of directors. In conjunction with Henry Hill, consulting engineer, he reported ore reserves proven and indicated, increased to 500,000 tons averaging 5% lead, .7% zinc and 1 oz. silver. He further recommended installation of a zinc circuit, start of a new shaft to establish two new levels, and increased bunkhouse and other surface facilities. If shaft sinking and low-level development substantiated drilling, he would recommend expansion of the mill to 450-500 tons daily.

★ **A new tungsten mine,** the Black Diamond, is being developed in northern B. C., 10 mi. east of Atlin: Black Diamond Tungsten Ltd. will spend $200,000 to block out enough ore to start mill production in the spring. Preliminary exploration has indicated more than 58,000 tons of high-grade wolframite ore. Five veins are being investigated on 52 claims and fractions.

★ Value of mineral production in British Columbia in 1951 is estimated at an all-time high of $164-million, $12-million over the previous record in 1948 and $16-million over last year. Mines Minister R. C. MacDonald reports production of all principal minerals was down, but higher prices made for the increased value. Gold was the exception, with value of output down $1,100,000. Total value of B. C. mineral production since 1852 is $3-billion.

★ **Here's a look into the future:** Several mills are prepared for production and by the end of 1953 it is estimated daily capacity of plants to treat silver-lead-zinc ore will have been increased by 1,500 tons. Production of asbestos from the McDame Creek deposit is expected to start in 1952. Substantial progress has been made in modernizing the lead smelting and slag fuming section of the Trail smelter. Enlarging of the Trail zinc plant also has been undertaken, along with development of power on the Pend Oreille River, transmission of power to Kimberley, and building of a sulphuric acid and ammonium-phosphate plant at Kimberley.

★ **British Columbia may ease** regulations on crown-held iron ore deposits to assist establishment of a steel industry in the province, Mines Minister R. C. MacDonald says. About two years ago, the B. C. Government placed a reservation on all province-owned deposits to give B. C. some

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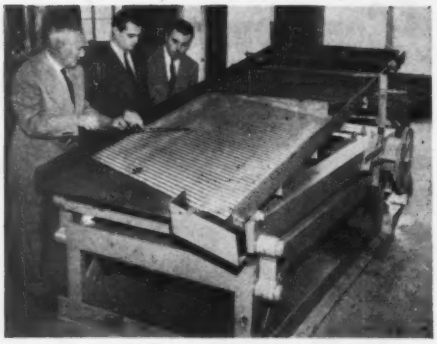

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British Columbia *(Continued)*

control over iron exports after the Dominion Government refused to prohibit such exports. Iron ore currently is being exported from privately held deposits at Quinsam Lake, Vancouver Island, by Argonaut Co. Ltd. Mr. MacDonald says exploration would be aided now by opening up other deposits and possibly would aid in setting up a steel industry.

★ **Western Uranium Cobalt Mines Ltd.** has started to produce concentrate from the Red Rose mine near Hazelton. It is also proceeding with plans to bring its copper-gold-tungsten Rocher de Boule mine into mill production despite conflicting engineers' reports. Hill and Associates recommended that work be stopped because only 11,050 tons of potential ore were indicated. But Prof. N. Kohanowski, of the University of North Dakota and assistant geologist of the North Dakota State Geological Survey, estimated ore reserves at 67,800 short tons reasonably assured, and more than 300,000 tons indicated; he estimated grade as approximately 4% of recoverable copper. A. L. Clark, director, and Prof. Kohanowski recommended installation of a mill.

★ **Jackson Basin Mines** in the Slocan is reported to have sufficient ore averaging 30 to 40% zinc and lead on its No. 5 level to justify a 40-ton mill. Consulting Geologist B. I. Nesbitt reports a 40-ton unit could be operated for about three years by blending high-grade with dump ore to yield a mill feed of about 15%

★ **Western Mines Ltd.**, lead-zinc producer near Ainsworth, plans round-the-clock operation of its mill as soon as nine mine cars are delivered and workmen complete laying of 1,000 ft. of track. First phase of the company's program is to increase output to 100 tons daily. Substantial ore tonnages are being opened in several sections of the mine.

★ **Van Roi Consolidated Mines Ltd.** has put its Heavy-Media Separation plant into operation. Daily tonnage treated was due to exceed 150 tons by the end of January.

★ **Estella Mines Ltd.**, completing its first full month of production in November, shipped five cars of lead and 11 cars of zinc. The company expected to ship 20 cars in December and more in January as the grade of ore increases.

★ **From near Sandon,** Silver Ridge Mining Co. has made an initial shipment of ore to the smelter. Returns to President Harry Pearson showed 68 oz. of silver, 60.5% lead and 5% zinc.

★ **Secretary David E. Watson,** of Thomas Consolidated, reports that development work at the War Horse mine is producing about 75 daily tons of ore. The War Horse vein had been cut off by a fault, and Thomas Con-

solidated drove through the fault, located the ore zone at a width of 3 ft. which ran 16.5% lead, 10.3% zinc, 5.01 oz. of silver, and 0.8 oz. of gold. Watson reports that crews have followed this vein for 100 ft. and that it is widening. He also says that diamond drilling has shown a 10-ft. vein of quartz in the hanging wall, parallel to the War Horse vein.

MANITOBA

★**San Antonio Gold Mines, Ltd.**, reports that deep-level development is continuing satisfactorily. The ore zone has been reached on the 17th, 18th, 19th, 23rd, and 26th levels. The 17th looks as good as the 16th (which was one of the best ore-makers in the mine). Crews have started cutting station on the 21st, 22nd, 23rd, and 24th, and the manner in which the 26th is opening up leaves little doubt that those upper levels will be productive. San Antonio is maintaining its ore reserves at approximately 700,000 tons, and is currently milling about 500 daily tons.

On adjoining ground, current developments suggest that Forty-Four Mines will be developed to the point where large-scale production must be considered.

★**Fairway Flin Flon Mines** reports that diamond drilling is in progress on its claims at Grant Lake: a pyrrhotite zone containing small amounts of copper is being investigated.

★**Manitoba Basin Consolidated Mines, Ltd.**, at a special general meeting, approved the granting of an option for sale of the company's six-claim property in the Herb Lake area.

★**MacDick Copper Mining and Smelting Co., Ltd.**, announces that diamond drilling is to be undertaken on its property 2½ mi. west of the old Sherritt Gordon Mine.

★**The Province of Manitoba** produced an estimated $19-million in metals during 1951 as compared with $24,744,980, the final production figure for 1950. The $5-million drop was due to the smaller recovery of ore from the Manitoba side of the Flin Flon orebody; the depletion of Sherritt Gordon in September; and the closing down of the Ogama-Rockland Mine in May of 1951. It is estimated the production of non-metallics will be comparable to that of 1950, approximately $8-million.

NOVA SCOTIA

★**Nova Scotia's** first lead-zinc producer in many years is expected to start shipping concentrates late in January. Mindamar Metals Corp. is nearing completion of its 500-ton mill. Financed and sponsored by Dome Mines, big veteran of Ontario's Porcupine gold camp, Mindamar is in the

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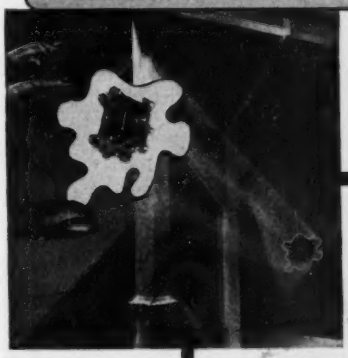

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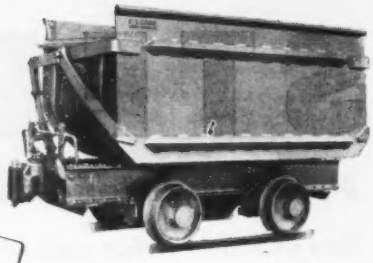

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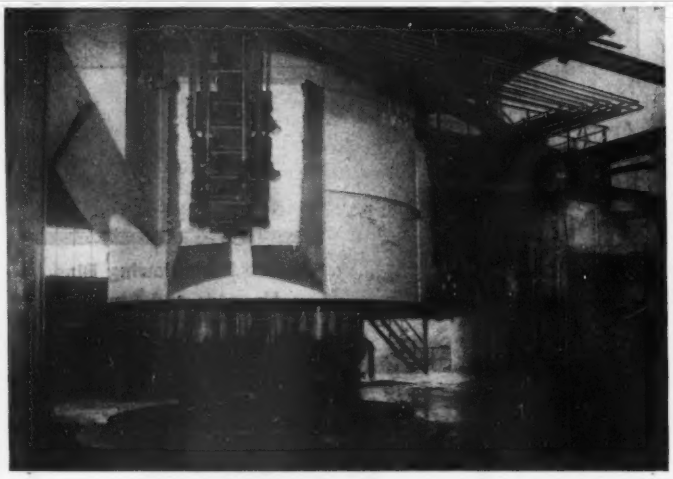

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Nova Scotia *(Continued)*

southeast section of Cape Breton Island. The new shaft has been sunk to 550 ft. and will be deepened to 1,000 ft. while the first four levels are readied for production.

ONTARIO

★ **Profits 10 times those of 1950** are estimated by New Dickenson Mines for 1951. The annual report will probably show net in excess of $425,000 compared with $40,734 in the previous year. Gold output of this young Red Lake producer was approximately $1.4-million, almost three times the $528,466 produced in 1950.

★ **Good progress** is being made by Falconbridge Nickel Mines in the development of its new Hardy mine in Levack Twp., Sudbury area. The shaft has been sunk to 1,000 ft., and will possibly be carried to 1,200 ft. before lateral work is started. Surface buildings for the plant are just about completed. The Hardy will be Falconbridge's third mine. (Its second one, the McKim, was placed in regular production at 500 tons daily during 1950.)

★ **Surface drilling** has been started by Great Larder Gold Mines on its optioned property in Robb Twp., Porcupine area, 18 mi. northwest of Timmins. The ground adjoins the Kam-Kotia which had a modest copper production during World War II.

★ **Latest oldtimer** to plan re-opening is Ontario Pyrites Co., holding the long idle Treadwell Yukon and Sudbury Basin properties in the Vermillion Lake section of the Sudbury area. Controlled by Ventures Ltd., the project has been financed by a million-dollar underwriting.

The property is big: its 8,000 acres cover a strike length of 10 mi. along the favorable structure. Surface drilling years ago indicated 1-million tons with low values in gold, copper, lead, zinc, and silver. Because metallurgy was complex and metal prices poor, work was suspended. Today, when prices are up, and the metallurgy doesn't look so difficult, the company plans a shaft to 650 ft., with levels from which to give the indicated ore closer investigation.

★ **Kelore Mines has optioned** the property of Lakemount Mines. Near Hawk Junction in the Michipicoten area, this nickel-copper prospect was drilled by the Timmins' interests in 1944. A large tonnage of indicated material was considered subcommercial at the metal prices then current. Kelore has agreed to spend $100,000 on further exploration and testing, and has the right to lease the property for 99 years for 10% of net profits.

★ **American Zinc, Lead and Smelting Co.** has optioned a large block of

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ground in the Shebandowan area, west of Port Arthur, part of it owned by Andowan Mines. Drilling will be done during the winter.

★ **Construction Aggregates Corp.** of Chicago has completed the first year of its large contract to strip the overburden from Steep Rock's "A" orebody. Clyde Davis was recently appointed general superintendent of this rather unusual stripping-by-hydraulic-dredge contract.

Pickands Mather will start a $600,000 project to drill its optioned area of the Steep Rock "C" orebody.

Inland Steel, which also hold option to a large area of Steep Rock's "C" orebody, has completed a large part of its drilling on the option.

QUEBEC

★ **Montauban Mines and United Lead and Zinc Mines,** two adjoining lead-zinc prospects in the Anacon area, plan joint action in mill construction. They have a 500-ton plant now on the drafting boards. The two companies have already combined to sink a joint shaft to 500 ft., with first level to be at the 300-ft. horizon, and it is expected that lateral work will be in progress by early spring.

★ **In the meantime** Anacon Lead Mines, pioneer producer of the area, pays its first dividend this month, a distribution of 10¢ per share on January 28th. In the last quarter of 1951 Anacon had record production close to $850,000 and ended the year with net current assets of more than $1.4-million.

★ **Golden Manitou Mines** broke all records in 1951, with net profits estimated at 55¢ per share compared with 25.15¢ in 1950, the previous record year. Production in 1951 passed the $4.6-million mark, with output in the final quarter swelled by millfeed from the wide and rich new east orebody. Profits for 1952 are expected to be even greater than those of 1951, unless the price of zinc declines.

★ **Both of Golden Manitou's** subsidiary mines are scheduled to be in production by mid-1952. Barvue Mines, now preparing for open-pit production on a 4,000-ton basis at its Barraute area property, is proceeding on schedule. And out in British Columbia, Mastodon Zinc Mines is building a 150-ton concentrator. The parent company holds 53% of Barvue and 50% of Mastodon, and expects a handsome return from both within a few years.

★ **Adjoining north of Barvue** in the Barraute area, Pershcourt Goldfields is busy shaft-sinking. The extension of the Barvue shear was traced last year for more than 3,000 ft. across the Pershcourt claims. Surface drilling early in 1951 outlined a possible 6-million tons of ore to depth of 1,000 ft., averaging 2.4% zinc and 2.17 oz.

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16"	4	1/8"	1/32"	28 Oz.
18"	4	1/8"	1/32"	28 Oz.
20"	4	1/8"	1/32"	28 Oz.
20"	5	1/8"	1/32"	28 Oz.
24"	4	1/8"	1/32"	28 Oz.
24"	5	1/8"	1/32"	28 Oz.
26"	5	1/8"	1/32"	28 Oz.
30"	4	1/8"	1/16"	32 Oz.
30"	5	1/8"	1/16"	32 Oz.
30"	6	1/8"	1/16"	32 Oz.
36"	6	1/8"	1/16"	32 Oz.
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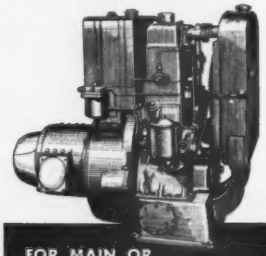

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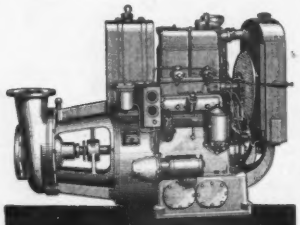

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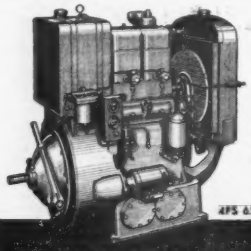

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Quebec *(Continued)*

silver per ton; or 2.8-million tons in the richer footwall of the zone, for which the average would be 3.45% zinc and 3.28 oz. of silver. The shaft is being sunk to 500 ft. with levels to be established at 300 and 500 ft. Crosscutting and drifting should start before summer.

★ **Rainville Copper Mines** is drifting in ore on each of its three levels where results are said to be confirming those by surface diamond drilling. The shaft was sunk to 450 ft. at this Bourlamaque area prospect last fall, and levels are being opened at 150, 275, and 400 ft.

★ **First work by O'Brien Gold Mines on the 3,300-ft. level** has shown ore in the main or No. 1 vein of the same good tenor encountered on the levels above. This Cadillac gold veteran had slightly lower profits in its 1951 fiscal year than in 1950 (3.5¢ versus 4.3¢ per share). Development work was curtailed during the year by lack of skilled labor. Ore reserves accordingly declined slightly to 130,721 tons averaging 0.393 oz. gold. Working capital, however, continues strong at $1.7-million.

★ **Lyndhurst Mining Co.** has outlined two lenses of copper in surface drilling at its property 30 mi. north of Noranda. The first is 125 ft. long averaging 2.12% copper across 23 ft.; the second, 75 ft. long averaging 3.35% copper across 17 ft. Both were intersected at a depth of 100 ft., and both carry about 1 oz. of silver in addition to the copper values. Drilling is continuing.

★ **Chibougamau Explorers Ltd.** has raised its authorized capital from 3 to 4-million shares. The new money will be used to start underground work and prepare plans for production. Extensive surface drilling of this Chibougamau area prospect has indicated a substantial showing of copper-gold ore. A bulk sample of core rejects averaged 0.486 oz. gold and 0.85% copper. If drilling results are verified by underground work, the company will probably start production at 1,000 tons daily.

★ **Campbell Chibougamau Mines** is well into bedrock with its shaft at Dore Lake. The shaft will go to 1,000 ft., and will have seven levels. The structure to be opened up has an indicated ore potential of 1,350 tons per vertical ft. averaging 3.5% copper and 0.15 oz. gold.

SASKATCHEWAN

★ **Mining Corp. of Canada** has been granted a 10,000-acre mining concession 75 mi. northwest of Lac La Rouge, between Waddy and Nistoassini lakes—next to Hudson Bay Exploration and Development Co.'s Con-

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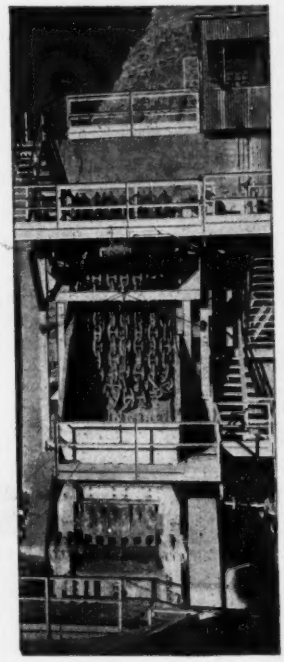

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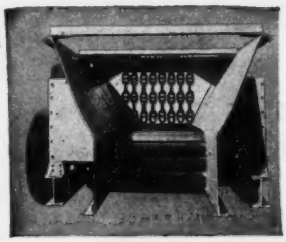

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YUKON

★**Bob Wilms,** president of Cassiar Yukon Gold Mines Ltd., brought 1,000 lb. of high-grade silver, lead, zinc to Whitehorse recently from the McDame Canyon area. It is to be sent for testing. Preliminary assays are said to run $200 to $300.

★**Barry O'Neill,** manager of Mayo Mines' Tundra property, reported that the lower tunnel, where two shifts were working on a contract basis, is 61 ft. from the portal and only a few feet from the footwall side of the vein which it will intercept at a lower level. A 60-ft. advance on the vein will bring it below the face of the upper tunnel. Samples have shown good-grade milling ore across 5 ft. of this vein. Samples from the dump of a shaft from the same vein 400 ft. to the southwest were reported to run as high as 2,000 oz. in silver. M. J. Boylen and associates are said to be financially interested.

★**Yukon Consolidated Gold Corp.** had to close operations of its No. 6 and No. 4 dredges early in November due to frost and lack of power but reported its other five dredges still operating. Production of the company was reported to be $346,000 in July and $316,000 in August.

IN AFRICA

★**Milling capacity at Rustenburg platinum** mine will, in two years, be stepped up to 125,000 tons per month. Also, plans have been made for installing a local refinery to treat the copper-nickel matte produced. Recent production statistics are not available— they are regarded as a secret. But sales for the first quarter of 1951 (after the ban went into operation) were nearly 31,000 oz. Milling capacity at that time was not more than 60,000 tons monthly, so the recent announcement means that production will be more than doubled by early 1954. Plans have also been made for opening up the platinum-bearing Merensky reef in the Northern Transvaal, some 150 mi. from Rustenberg.

★**In Rhodesia,** the Gwelo ferrochrome plant is scheduled to be ready for first-stage production by May, according to John Miles and Partners, British consultants for the plant. The plant will turn out the highest grade of low-carbon ferro-chrome.

★**South Africa,** with tin production rising, may become self-sufficient in that commodity during 1952. New discoveries at the Rooiberg "C" Mine are described as being of major importance. Development at depth has revealed one section of 400 ft. that

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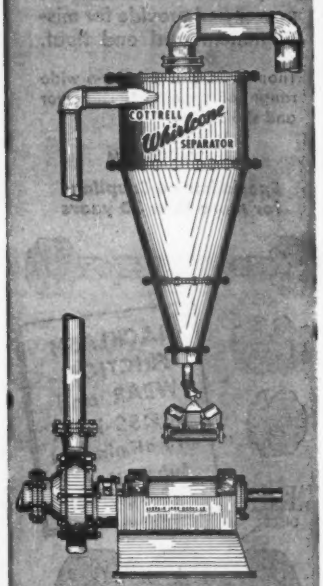

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Africa *(Continued)*

is 100% payable and averages 2.4% over a channel width of 20 in. At the Zaaiplaats plant, which treats concentrate from all the operating mines in the Union, production of ingot tin during the year 1950-51 was up to nearly 1¾-million lb. (compared to 1½-million the year before). Zaaiplaats is increasing its own production, and, in addition, a number of new producers will begin operation in 1952.

★**Crews have completed** reconditioning of the old plant at the Krantzenburg tungsten mine in Southwest Africa, and have produced and exported their first wolframite concentrate. The new rougher plant was scheduled to start in January, and was expected to increase production substantially.

IN ASIA

★**Karen rebels and Siamese bandits** have seized Namyin tin mines, on the Burma-Siam border. They killed eight Chinese and a number of Burmese and Indian employees. So the situation now is that with the exception of Kansauk mines, 52 mi. north of Iavoy, all the mines in Tennasarim district—mines which produced about half the country's tin and tungsten—are now under rebel control.

★In central India, geologists have found and reported on bauxite deposits estimated to contain 8-million tons. The deposits, which extend over 100 mi., are to be exploited by the government shortly.

IN AUSTRALIA

★**Australia's mining boom** continues. From July 1 through Oct. 31, 1951 (the last reported four-month period), exports totaled £15.5-million, up from 11.7-million in the previous period. Tungsten went up nearly six times; titanium and zirconium minerals nearly doubled; and exports of silver bullion rose too.

★**Japanese steel** will speed completion of the new aluminum plant at Bell Bay, Tasmania. The plant is scheduled to begin production in 1954, and will be rated to produce 13,000 annual tons of ingot aluminum. Initially, bauxite will come from India; later, it may come from Australian sources.

★**Montana Silver Lead N.L. of Zeehan, Tasmania** is operating the first section of its mill, and is breaking in the second section. Four stopes have been extended in good-grade ore.

★**Aberfoyle Tin N.L. has contracted** to sell its wolfram concentrate to the British Ministry of Supply. The con-

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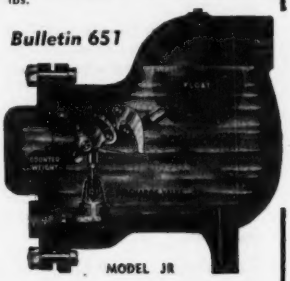

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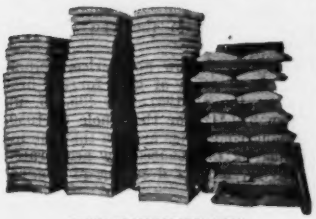

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tract runs for four years; it specifies the current price at the time of delivery, but guarantees a minimum price.

★**Australian Development N.L.** boosted its annual profit to £340,572, nearly double that for the previous year. It produced 31,695 oz. of gold from ore that averaged 44.8 dwt. (2.24 oz. per ton). Ore reserves are estimated at 206,000 tons The new primary crushing installation is scheduled for operation in late 1952. Meanwhile, 27,500 tons of tailing estimated to contain 13,800 oz. of gold are ready for treatment in the cyanide plant, which should be ready to go pretty soon.

★**Specimens of high-grade silver-lead ore** have been brought in from a new field in the Arnhem Land Native Reserve, about 350 mi. south of Darwin. According to the Northern Territory's Director of Mines, the specimens ran 30 oz. of silver and more than 70% lead. Geologists are now in the field studying the area.

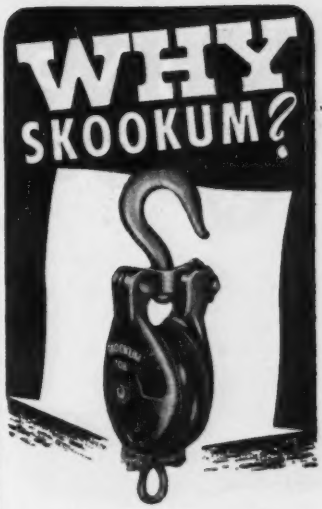
IN EUROPE

★**Behind the Iron Curtain,** the region of Saalfeld-Rudelstadt in the province of Thuringia is now forbidden territory, according to the West Berlin **Telegraf.** (Soviet geologists recently discovered uranium deposits there.) **Telegraf** goes on to say that all citizens not classified as indigenous will be evacuated by March.

★**Chrome mining** in Turkey is responding to the stimuli of high and rising prices, and Marshall-plan aid. The price has risen from $35-38 to $43.50-46, and is still rising. Central Europe, Germany, and Northern states are buying increased tonnages of chromite. The first private firm to benefit from Marshall aid was Sadullah Bilgi of Iskenderum, which exported 10,000 tons in 1951.

★**Italy** has allotted 9-billion lire (about $10.5-million) for modernization of the Sicilian sulphur-mining industry. The outlook is for a 10% increase in production in 1952—for a total of about 250,000 tons. This increase will not significantly help to solve the world shortage.

★**In free Germany,** a uranium find of 1949 will reach a point of decision in February, 1952. The find was in the Black Forest, near France and Switzerland, where secondary minerals were discovered. The existence of uranium minerals had been known for 100 years, but discovery of a large amount in an old mine in the district of Wittichen sparked new interest in the possibility of mining. The Government of "Land" then Baden authorized the Geological Institute Baden to investigate the discoveries. Now, with a number of claims pegged by private interests, and with its studies completed, the government will soon clar-



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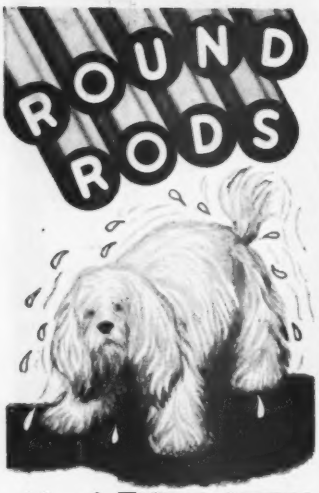

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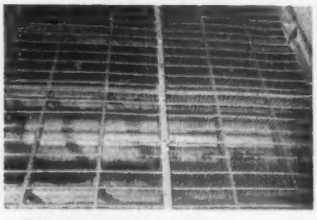

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In Europe *(Continued)*

ify its policy toward mining these deposits.

★**Italy's expansion in zinc** took a step forward with the signing of a contract for further improvements to increase output of the zinc smelter at Nossa, near Bergamo in northern Italy. Signers were representatives of the ECA mission to Italy and officials of Sapez (Lead & Zinc Co., Ltd.). The smelter (now being erected) is to be completed by the end of 1952 at a cost of about 934-million lire. Officials of Sapez estimate that completion of the smelter will provide work for another 1,050 men—350 at the smelter, and 700 in the associated Sardinian mines.

★**In the toe of the Italian boot,** Calabria may be a region of mining possibility. A recent meeting of scientists called attention to Calabria's mineral resources, which include iron ore, lead, silver galena, graphite and a huge deposit of very low-grade manganese. This manganese deposit at Normanno extends for some 500 acres and is free of impurities, but contains only about 5% Mn. The scientists believe that because of the 10-year plan for improving transport, communication, and industrial facilities, Calabria will be a profitable field for mining investment. Also favorable is the fact that Calabrese are expert miners.

IN LATIN AMERICA

★**Rail service,** especially in northeastern Mexico, has improved greatly of late. Monterrey, the Nuevo Leon area, Tampico, and Brownsville, Tex., are among the points to benefit from new rolling stock running on schedules that take less than half the time of former ones. To take care of the increased cost, rates for 1952 have been raised.

★**Mexico may soon** ship iron ore from the Pacific coast. Two mining men, Eduardo del Paso and Luis Sierra, plan to ship 30,000 tons monthly from deposits at Piscicola, Michoacan. It will go via a fleet of 17 Liberty ships, which will deliver most of the product to U. S. Pacific Coast ports.

★**Andres Lara C. de Mogone** is forming a company to work silver, lead and iron deposits near Villa de San Juan Guichicoci, Oaxaca, Mexico.

★**Jesus Mendez Chavez** is preparing to exploit what he describes as rich mercury deposits near Chilpancingo, Guerrero.

★**Cia. Minerales Mexicanos, S. A.** is preparing to exploit, on a large scale, tungsten, lead, and zinc deposits it holds near Leon, Guanajuato.

★**Brazilian-American** crews completed initial surveys which will lead to exploitation of manganese deposits in Amapa. The Amapa deposits, said to contain more than 10-million tons of high-grade manganese, are being exploited by a Brazilian-United States company called Icomi, S.A.

★**Brazil's Industrial Development Commission** is studying a plan under which Reynolds Metals Co. would participate in a 100,000-annual-ton aluminum plant in the Sao Francisco Valley.

★**Despite the low gold price,** Columbia's production of gold for the first 11 months of 1951 was 405,175, up from 379,412 for the whole of 1950. Mining companies explain that the increase is not caused by accelerated activity, but by dredging of higher-grade ground.

All of Columbia's 1950 production of platinum went to the United States; it was 761 kilos valued at $10,426,620 U. S. Starting in December of 1951, under terms of a trade agreement, part of Columbia's platinum will go to Germany.

★**Finding of uranium minerals** in Chile has sparked an active search for radioactive minerals in many Chilean mining camps.

★**The Paipote smelter,** in steady operation, has a three-month stockpile of ores, concentrates, and fluxes. Management expects Paipote to produce 1,200 tons of blister copper monthly.

★**At Copiapo, Chile,** Sali Hochschild and Co. is experimenting with production of copper by the roast-leach-precipitate system. Copper concentrate is given a sulphatizing roast in a Wedge roaster, leached and precipitated on scrap iron. (This kind of operation has often been tried, but with no success. Sali Hochschild hopes to solve the riddles involved.) The company is also installing a small furnace to fire-refine cement copper.

★**Most Chilean copper mines** are increasing their milling capacity. Among these are Disputada, Zaita, Tocopilla, Punitaqui, and Farellon Sanchez.

★**On behalf of the Banco del Brazil,** mining engineers from Brazil are examining sulphur deposits at Laxante Hill in the department of Africa, Chile.

Alumni Functions at the New York Meeting of AIME:

Tuesday, February 19, 1952

Colorado—Cocktails from 5:00 to 7:00; Statler Hotel
Michigan—Cocktails at 6:30; dinner 7:30; Statler Hotel
Missouri—Cocktails at 5:30; dinner at 6:30; 2 Park Ave.
Montana—Cocktails at 6:30; dinner at 7:30; Statler Hotel

Thursday, February 21, 1952

Columbia—Luncheon at 12:15; Statler Hotel

Send reservations for these functions to your alumni representative or to Howard L. Waldron, E&MJ, 330 W. 42d, New York.

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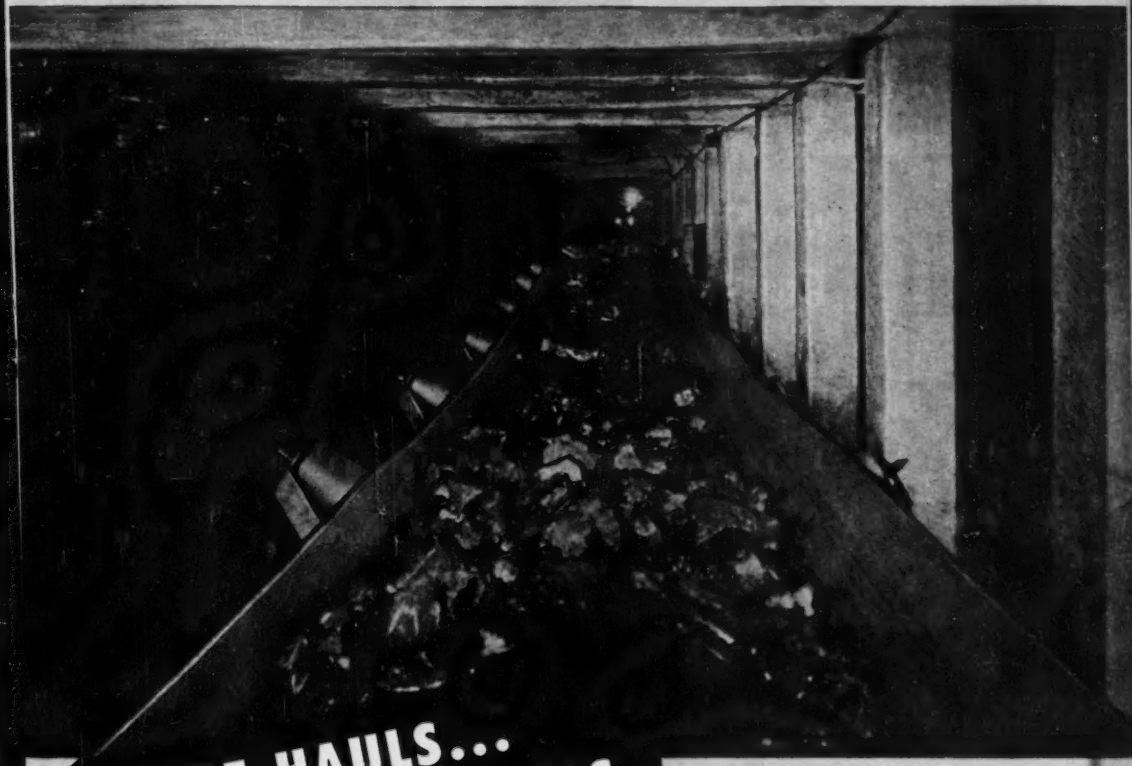

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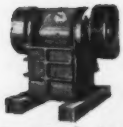

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Tests, like those conducted by the large copper concentrator pictured above prove that comparing capacity for capacity, horsepower for horsepower, cost per ton of ore processed and smelter receipts for concentrates produced, DENVER "SUB-A's" *are best by a very substantial margin.*

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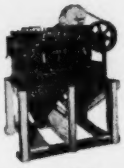

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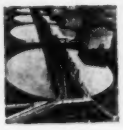
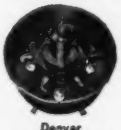


Denver Thickeners



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After finishing the three-mile road, the Big Red TD-24 stripped the overburden, then helped pave and stabilize the road with the first coal mined! Here's how owner Patrick Romano feels about TD-24 performance: "We didn't think it was possible, but the TD-24 built that road in less than three months. It's a powerhouse dirt pusher that we couldn't do without."

This West Virginia mining operation is only one example of how International's TD-24—the Big Red Champ of crawlers—is opening deposits that couldn't be mined profitably before.

Your local International Industrial Power Distributor has other case histories of how Internationals have made unworked mine property pay off. See him today. Inspect his full stock of approved parts. Watch his factory-trained mechanics at work. You'll know then why International can deliver the *"Power that Pays"* for you over many years of top production.

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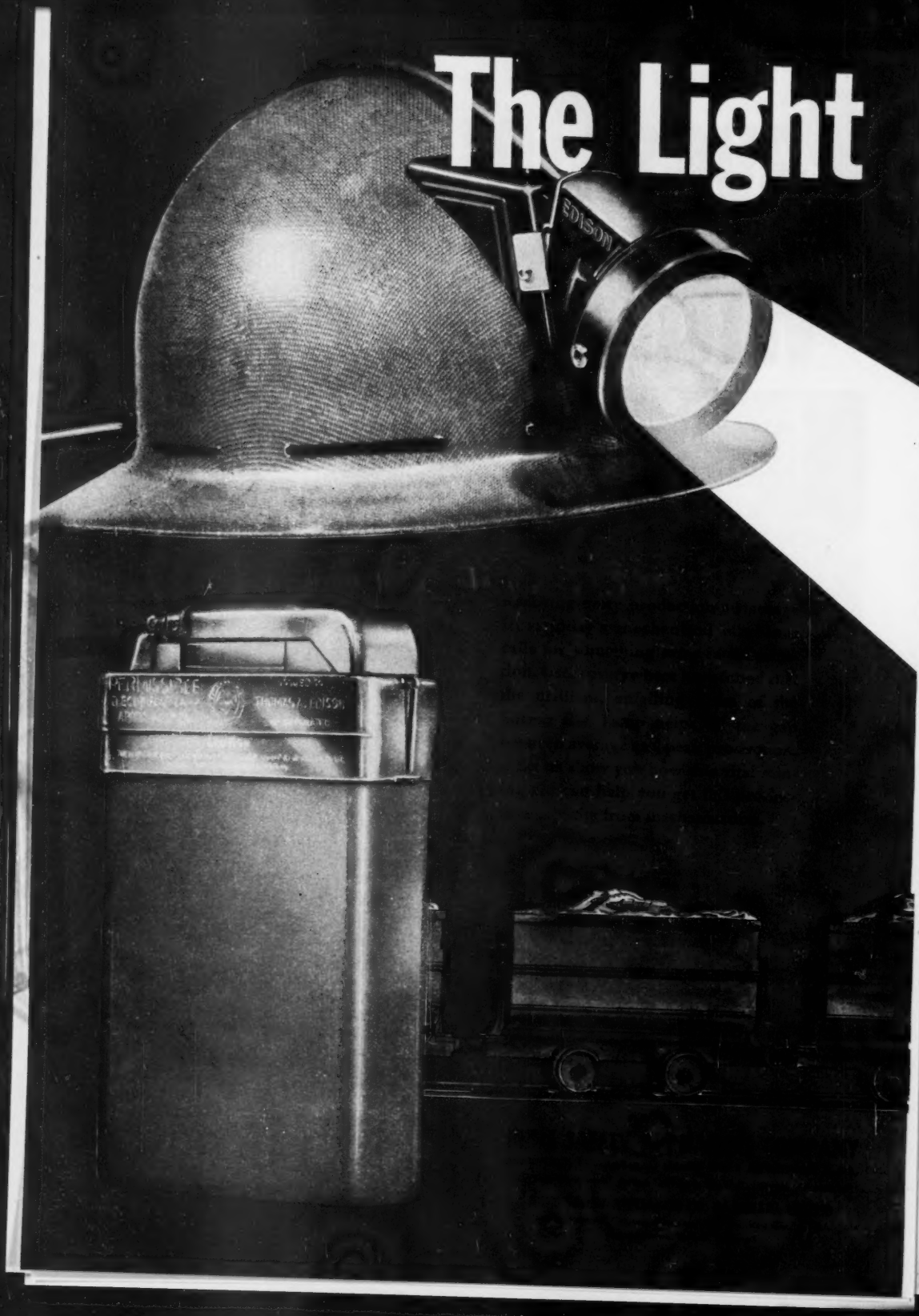
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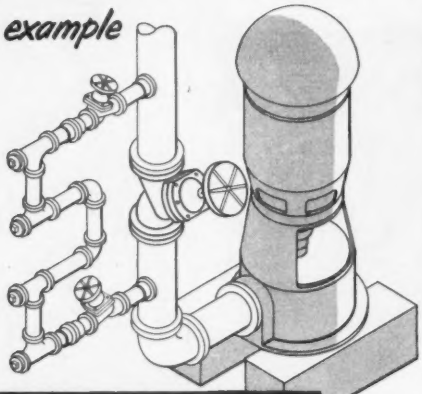
How's This For Solving a Valve Problem ...on Corrosive Well Water,

for example



THE INSTALLATION

On outlet of well water pump supplying plant of Barr Rubber Products Co., Sandusky, Ohio. Sulphur content of water extremely high.

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SUITABILITY:	Just what was needed
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CORROSION-RESISTANCE:	No evidence of corrosion
SERVICE LIFE:	Outlasted any 2 other valves so far
OPERATING RESULTS:	Pump shutdowns for valve repairs stopped
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AVAILABILITY:	Stock item in Crane line

THE HISTORY

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Problem solved by replacing with Crane Packless Iron Body Diaphragm valves in main line and by-pass. Installed more than a year, they show no corrosion, no effects of service. Operate smoothly, seat tightly, with no maintenance needed to date.

THE VALVE

Crane No. 1611 Iron Body Packless Diaphragm Valves featuring separate disc and diaphragm. No packing to maintain; no stem leaks. Neoprene diaphragm used to seal bonnet only. Independent disc with neoprene insert insures positive seating even should diaphragm fail. Also fully neoprene lined valves. Many common and corrosive services. See your Crane Catalog or Crane Representative.

The Complete Crane Line Meets All Valve Needs. That's Why,

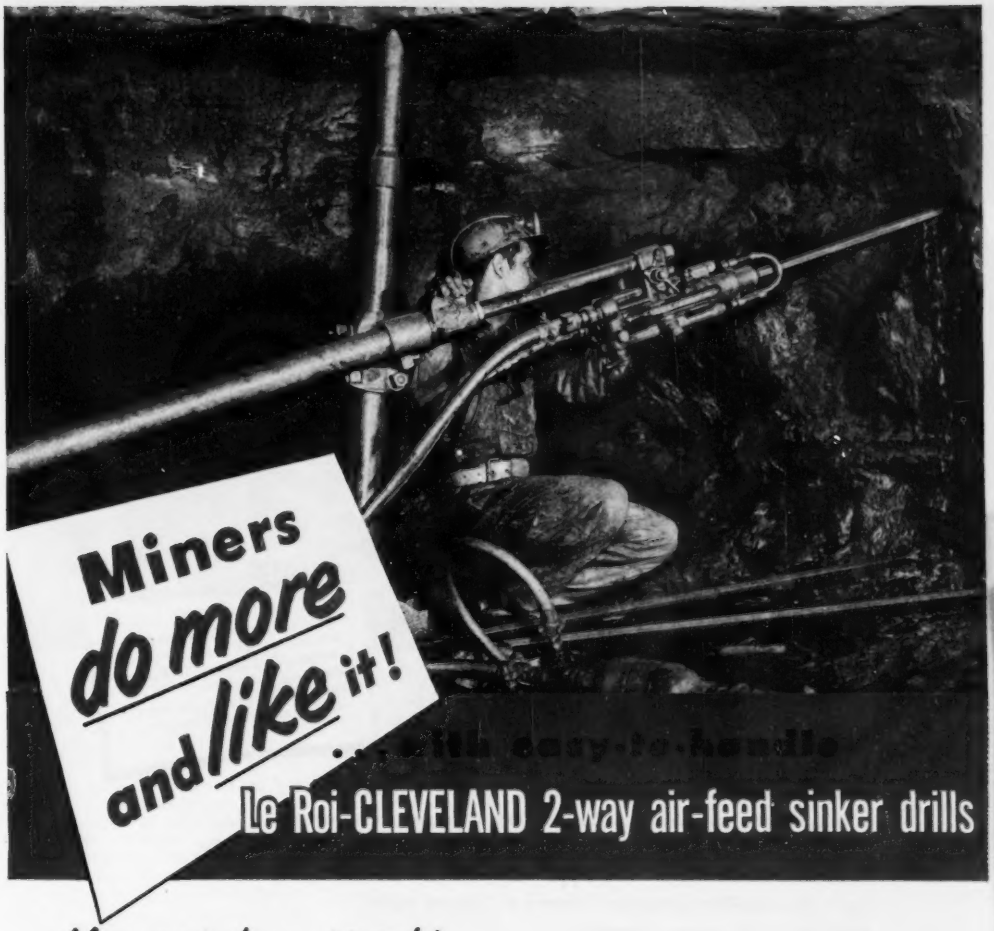
More Crane Valves Are Used Than Any Other Make!

CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois

Branches and Wholesalers Serving All Industrial Areas

VALVES · FITTINGS · PIPE · PLUMBING · HEATING



Men get less tired!
Safety records improve!
Tonnages rise!

TAKE the hardest part of the work out of drilling and speed it up, too. Equip your miners with Le Roi-CLEVELAND HC10 Air-feed Sinker Drills — then watch tonnages per man-shift go up.

A lightweight column — pneumatic- or screw-type — supports the HC10. Setting-up takes only a few minutes. Feeding is done by air-pressure. All controls are handy.

Quick reverse feed makes it quick and easy to change steels. There are no swing or dump nuts to loosen or tighten.

The fast, light blows of Le Roi-CLEVELAND Air-Feed Sinker Drills are just right for carbide bits. You get maximum bit life — can use smaller bits for higher drilling speeds.

In addition to the popular HC10 model with 45-lb. drill, Le Roi-CLEVELAND Air-feed Sinker Drills are available in an HC23 model with 3⅛" bore. Both models help your miners produce more footage and greater tonnages. And because the men don't get so tired, safety records improve.

Write today for complete information.

LE ROI COMPANY RD-44
CLEVELAND ROCK DRILL DIVISION
12500 Berea Road, Cleveland 11, Ohio
Plants: Milwaukee, Cleveland and Greenwich, Ohio

HERE ANACONDA TRADES TIN CANS FOR COPPER!

Anaconda's new Copper Precipitation Plant at Butte, Montana, consists of six launders. Each launder is divided into five 100-ft. sections. A drop tank at the end of each section traps the copper precipitate.

Here is a picture of ingenious "copper mining"!
In this copper precipitation plant at Butte, mine water containing copper sulphate in solution is pumped from underground operations. As it flows over shredded, detinned cans, a basic chemical reaction takes place. The iron frees the copper from copper sulphate in solution. This reaction results in a mud-like precipitate — known as "cement copper" — which has a 75% copper content!

Thus, by an application of basic chemistry, Anaconda recovers about 750,000 pounds of copper every month! The new plant, recently completed, handles more than 30,000 *tons* of mine water a day. From this ocean of copper-laden water the precipitation process recovers an average of 93% of the copper which would otherwise wash away.

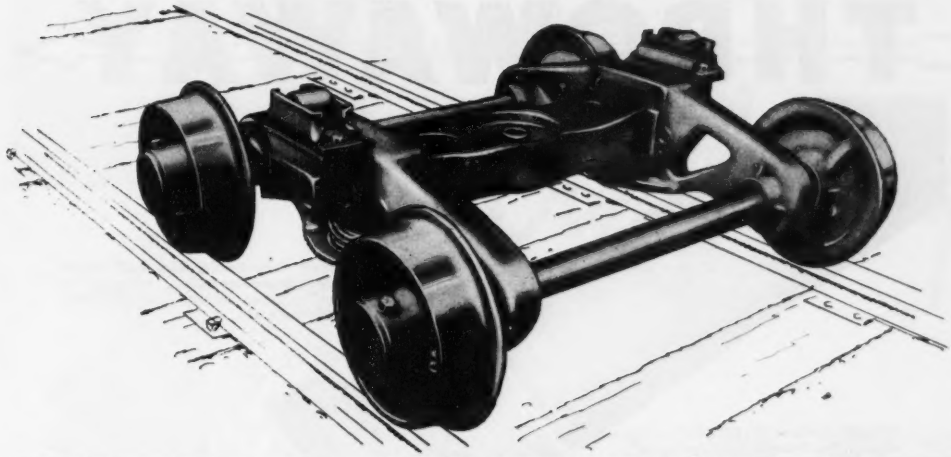
This phase of Anaconda's current modernization and expansion program is matched by dozens of other new developments in mining and metallurgy, as well as in refining and fabricating operations. Thus is Anaconda continually pioneering significant new frontiers in the field of metals.

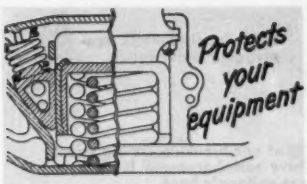
ANACONDA
COPPER MINING COMPANY

The American Brass Company
Anaconda Wire & Cable Company
International Smelting and Refining Company
Andes Copper Mining Company
Chile Copper Company
Greene Cananea Copper Company

51388A

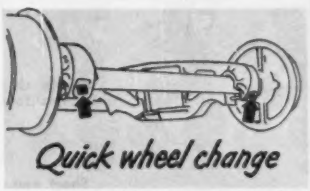
Specify NATIONAL NC-1 trucks for your large 8-wheel mine cars



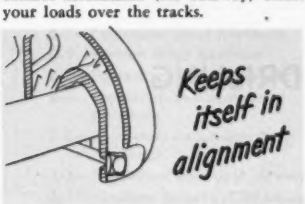


Shock-absorbing system of the NC-1 truck is similar to designs of the American Association of Railroads for full-size freight car trucks. The oscillation control mechanism (see cutaway) floats your loads over the tracks.

Track irregularities are no hindrance to higher speeds for mine cars when they are equipped with National NC-1 trucks. Truck design and large diameter, low stressed, load-carrying springs improve riding qualities.



Removal of bolt at each end of side frame permits quick wheel and axle assembly change. Cuts repair time and costs . . . keeps cars in operation longer. No lengthy tie-ups for wheel and axle changes on a National NC-1 truck.



The NC-1 truck stays square automatically. V-shaped slots over the axles make it impossible for the truck to get out of square without lifting entire weight of the car body and lading—means longer service, less repairs.

National NC-1 truck's large center bearing provides maximum wear life by reducing per-square-inch loading... provides bolster stability. Has easily replaceable centerplate shims and adequate provision for lubrication.

Side frame and bolster are each of one-piece, integrally cast construction similar to the National C-1 trucks used on railroads. Gives maximum strength, minimum weight—has *no welds or rivets to shake loose.* A-2920

For minimum maintenance time and spillage, plus maximum equipment protection—specify National NC-1 trucks on your next 8-wheel mine car order.

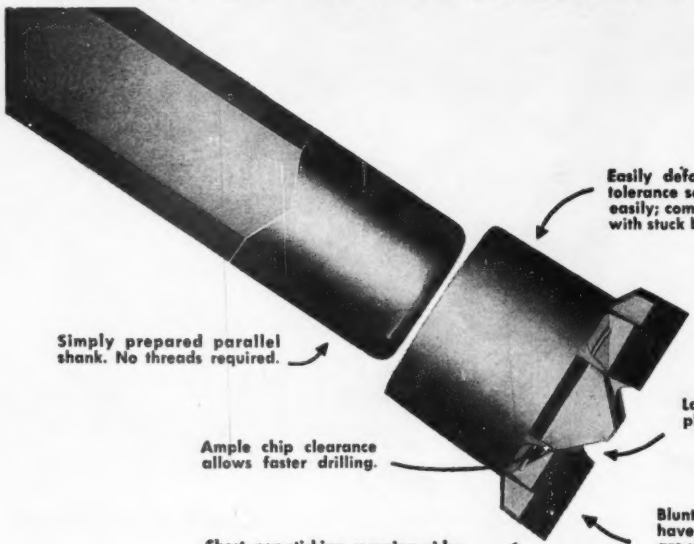
NATIONAL MALLEABLE and STEEL CASTINGS COMPANY

Cleveland 4, Ohio

WILLISON AUTOMATIC COUPLERS • DRAFT GEARS • NACO STEEL WHEELS

NATIONAL Products FOR TRANSPORTATION AND INDUSTRY

THROWAWAY


Easily deformable skirt with close tolerance socket hole . . . bit goes on easily; comes off easily; no lost time with stuck bits.
Simply prepared parallel shank. No threads required.
Large hemispherical non-plugging water outlet.
Ample chip clearance allows faster drilling.
Blunt non-breaking cutting edges have self-sharpening tendency — are uniformly hard.
Short non-sticking reaming sides allow close gauge following.

LOWER YOUR DRILLING COSTS
with
SMALLER HOLES AND FASTER DRILLING

Bottom with 1¼" Hole

Save Powder and Steel

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THE "TEST" WILL PROVE ITS WORTH

THROWAWAY BIT CORPORATION

4200 N.W. Yeon Ave. Portland, Oregon, U.S.A.

Fully descriptive literature on all products is available. Competent field engineers and dealers are always at your service.

Some territories still open for distributors and jobbers.

Bear Brand Xanthates bring . . . Uniformity

BEAR BRAND XANTHATES
available

- Z-3—Potassium Ethyl Xanthate
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- Z-5—Potassium Amyl Xanthate*
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- Z-8—Potassium Secondary Butyl Xanthate
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- Z-11—Sodium Isopropyl Xanthate

*From Sharples Amyl Alcohols

The constant uniformity of Bear Brand Xanthates is one of the outstanding characteristics of these widely accepted flotation reagents.

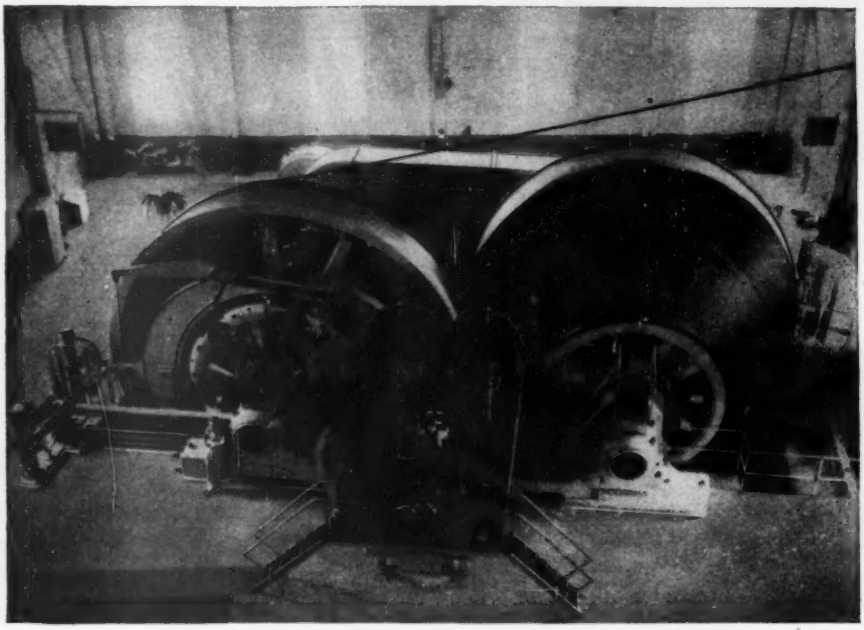
Users know that any single drum or carload of drums can be depended upon to show the same quality as previous or subsequent shipments.

"Over Twenty-five Years Experience in Producing Xanthates for Metallurgical Use"

THE DOW CHEMICAL COMPANY
San Francisco 4, California, U. S. A.

DOW CHEMICALS

WIRE ROPE



For shaft, incline and haulage service specify Roebling

WHEREVER WIRE ROPE is subjected to excessive abrasion or bending and acceleration stresses . . . to heavy loads and high speeds . . . the proper Roebling Preformed "Blue Center" Steel Wire Rope will last longer and save money. "Blue Center" steel is an exclusive Roebling development that assures real toughness. Roebling Preformed also adds extra handling ease and smooth performance.

Roebling makes a full line of wire rope. Have your Roebling Field Man recommend the ones that will meet your needs with top efficiency and economy. And for biggest savings, get his advice on the correct use and maintenance of wire rope. John A. Roebling's Sons Company, Trenton 2, New Jersey.

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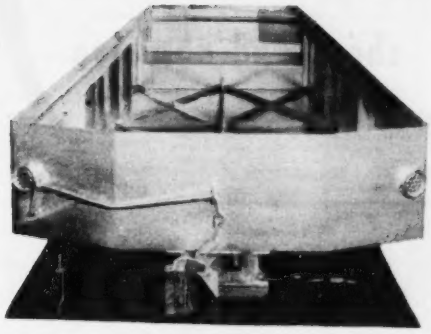
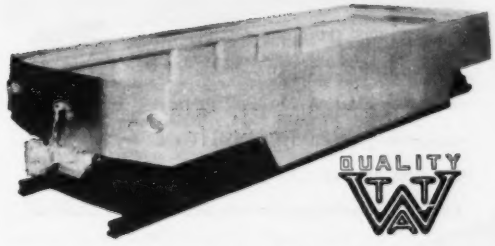
THIS WATT STREAMLINED 8-WHEEL MINE CAR

. . . Was Designed to Haul Potash Ore





THE CAR ILLUSTRATED is one of all steel construction. Note particularly how it is reinforced with bracing to provide additional strength for this severe service. Also note the two angles on the inside of the car near the top which permits the reduction in the height 6" if needed, should a lower vein of ore be encountered, without reducing the strength in any way and without any effect on any of the other valuable features of the car.

As shown here the car stands 42" high above the rail, is 21' long inside, 90" wide inside for 48" gauge. It has a cubical capacity of 401 cu. ft. level full, giving an equivalent of approximately seventeen tons of potash ore.

We maintain a staff of engineers to design cars for hauling bulk material and shall deem it a privilege to receive your specifications, so that we may design for you what will fit your requirements, and fill your orders for same .

Investigate. For modern sturdy cars capable of high speed haulage at low cost, contact The Watt Car & Wheel Company.

The Watt Car and Wheel Company

1962 WATT AVE., BARNESVILLE, OHIO, U. S. A.

Industrial rubber products especially built for LONG SERVICE

PIONEER

Tough "TENSILITE" is your answer to problems of shock and abrasion

Arrow shows Tensilite-protected steel bang board stop on a Morrison-Knudsen project of reducing a mountain to ballast for the Union Pacific Railroad.

Tensilite can be furnished in many forms, from thin pieces in ounces to huge slabs in tons. The above piece will be used in forming parts for airplanes.

Pioneer's TENSILITE has proved itself to be one of the toughest rubber compounds ever developed. In the operation pictured above, a heavy steel plate was destroyed after being battered by 15,000 tons of sharp silica rock in ½" to 2½" pieces. Now a ½" sheet of Tensilite chute lining in front of the plate lasts through 45,000 to 50,000 tons of rock, and the steel remains undamaged! In another instance, a hardened steel plate used in milling rice wore through every 24 hours. Quarter-inch Tensilite, used in the same place, showed only slight wear after a month! Tensilite is used in many forms in many industries—aggregate, gold recovery, food processing, mining, explosives, and aircraft, to name a few. Wherever abrasion or shock destroy equipment prematurely, TENSILITE is the best answer. Call your nearest Pioneer representative for full details!

Send for Pioneer's newest booklet entitled 'METABOND', a complete handbook on rubber linings, coverings, and rubber covered rolls.

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BELTING • INDUSTRIAL HOSE • FIRE HOSE • PACKINGS • RUBBER COVERINGS AND LININGS, SPECIALTIES

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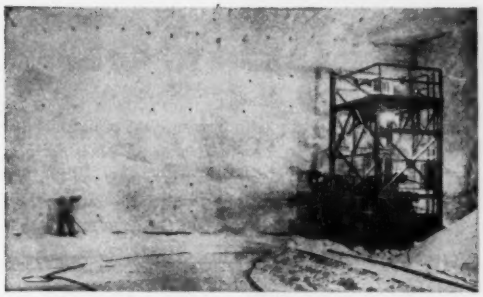
A Switch to DuPont "MS" Delay Caps

produces better fragmentation



When the Avery Island, Louisiana, Mine of the International Salt Company switched to Du Pont "MS" (Millisecond*) Delay Electric Blasting Caps, (replacing old-style delays), fragmentation was greatly improved, and a much more economical drilling pattern was adopted. Picture above shows face drilled and ready for loading.

Loading face with Du Pont Extra Dynamite. Rooms average 25' high by 75' wide. Average round consists of 108 holes drilled to same depth as the undercut, about 11 feet. All loading in this mine is done from the drill jumbo shown in picture at the left. Parallel series hook-up is used in firing the blast.

Miners making primers with Du Pont "MS" Delay Caps. In this face they use "MS"-75 to "MS"-300 inclusive. This customer also recently replaced cap and fuse with "MS" Delays in their high roof operations, and obtained exceptionally good fragmentation.

A typical shot in this mine with Du Pont "MS" Delay Caps. Customer reports greatly improved fragmentation, practical elimination of secondary blasting, reduced concussion and lowered drilling costs. These millisecond interval delays are giving similar results in many types of underground mining operations.

If you would like to improve fragmentation and cut costs, why not try Du Pont "MS" Delay Electric Blasting Caps in your mine? The Du Pont Explosives representative in your area will be glad to give you complete information on these short-interval delay caps. Call on him soon. E. I. du Pont de Nemours & Co. (Inc.), Explosives Department, Wilmington 98, Delaware.

DU PONT EXPLOSIVES

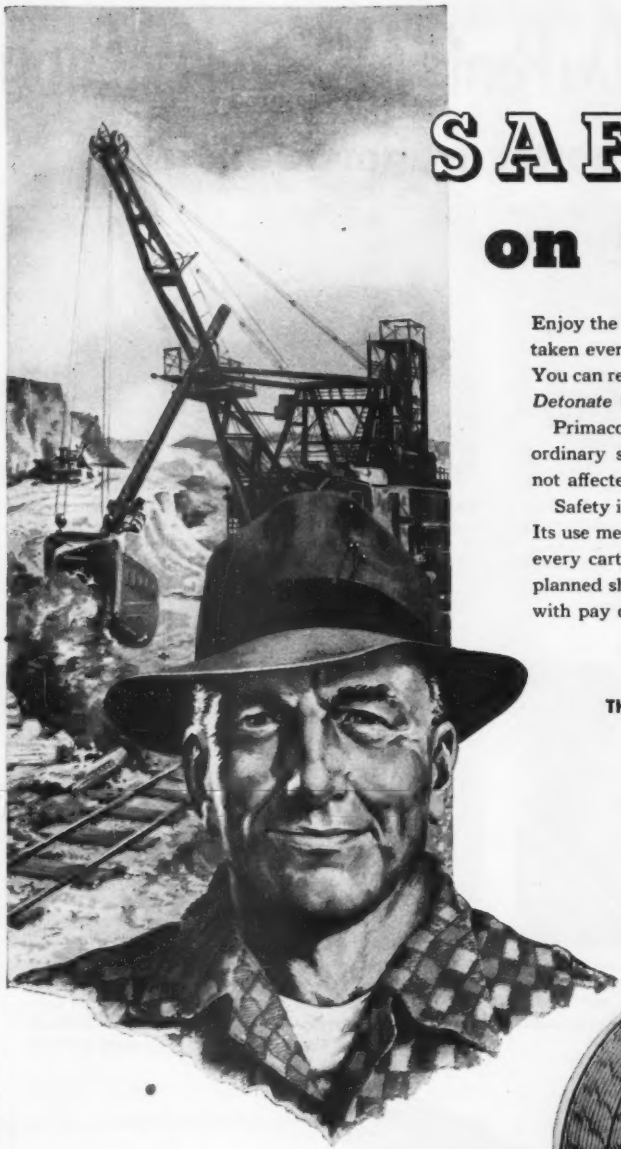
Blasting Supplies and Accessories

DU PONT

REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

* *Available in 14 millisecond delay intervals: MS–25, –50, –75, –100, –125, –150, –175, –200, –250, –300, –350, –400, –450, –500.*



SAFETY
on the Job

Enjoy the satisfaction of knowing that you, too, have taken every safety precaution on your blasting jobs. You can remove many a hazard if you *"Hook Up and Detonate with PRIMACORD."*

Primacord cannot be set off by friction, sparks or ordinary shock — it requires a blasting cap. It is not affected by stray currents.

Safety is not the only reason you need Primacord. Its use means faster, easier loading; positive firing of every cartridge in the hole; better fragmentation in planned shots. It helps to keep your shovels digging with pay dirt in every load.

For further facts, ask your explosives supplier, or write direct

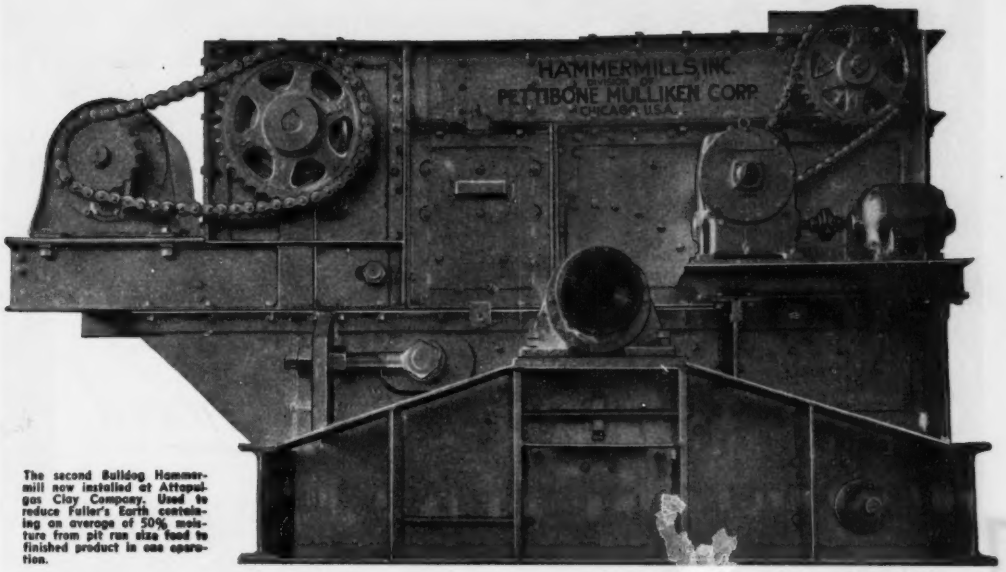
THE ENSIGN-BICKFORD COMPANY
SIMSBURY, CONNECTICUT

Also Safety Fuse since 1836

PLAIN PRIMACORD for shallow holes and surface trunk lines; **REINFORCED PRIMACORD** for deep holes and resistance to abrasion; **WIRE COUNTERED PRIMACORD** for deep ragged holes; **PLASTIC REINFORCED PRIMACORD** for deep, wet holes and river crossings.

Use PRIMACORD®

The PROVED and APPROVED DETONATING FUSE



The second Bulldog Hammermill now installed at Attapulgus Clay Company. Used to reduce Fuller's Earth containing an average of 50% moisture from pit run size feed to finished product in one operation.

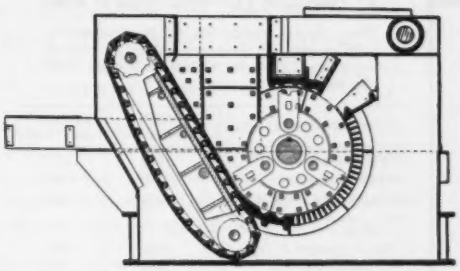
BULLDOG HAMMERMILL

with moving Breaker Plate

For wet, sticky material reduction . . . for those tough, heavy-duty crushing jobs.

Illustrated above is the last word in Moving Breaker Plate Hammermill design. It is built by an engineering organization whose experience far surpasses any organization that might furnish Moving Breaker Plate crushing equipment.

Design Improvements have increased reduction efficiencies and lowered H.P. requirements. You can see this equipment in operation at any time. Also Hammermills will gladly survey your reduction requirements and recommend the proper equipment without cost or obligation. Just write or call.



Bulldog Hammermills are built in capacities up to 1000 tons per hour for every purpose: for primary, secondary, fine reduction of materials such as limestone, shale, Fuller's Earth, phosphate muck, phosphate mud balls, iron ore, oyster or clam shells, any reducible material.

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Chicago 51, Ill. • Phone Spaulding 2-9300

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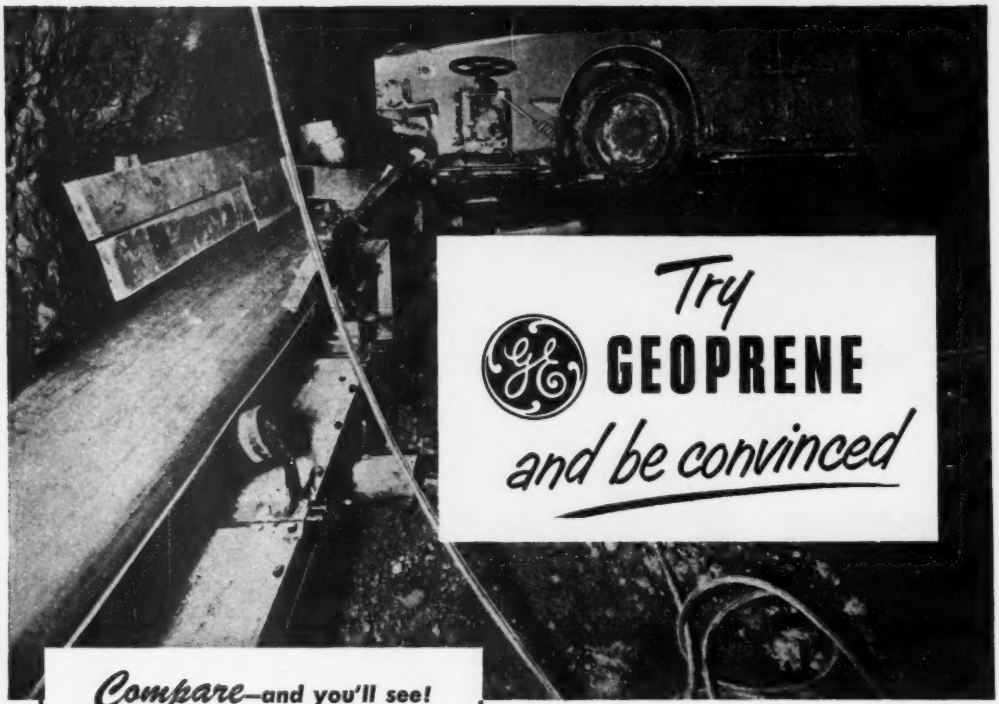


Try GEOPRENE and be convinced

Compare—and you'll see!

These figures, comparing ASTM requirements with typical G-E Geoprene values, indicate at once the superiority of portable cable with Geoprene sheath:

ORIGINAL	ASTM Requirements	Geoprene Typical Values
Tensile strength, lb/sq in.	1800	3000
Per cent elongation	300	500
Set in 2-in. test piece, in.	3/8	1/16
After 7 days in Geer oven at 70 C		
Tensile strength, lb/sq in.	1600	2900
Per cent elongation	250	430
After 96 hr in oxygen bomb at 70 C		
Tensile strength, lb/sq in.	1600	2800
Per cent elongation	250	430
After 18 hr in oil at 121 C		
Per cent depreciation in tensile strength	40	35
Per cent depreciation in elongation	40	35
Tear Test		
Tensile strength, min lb/in.	40†	75

†This is the requirement for rubber jackets; no tear value has yet been set for neoprene-type jacket.

General Electric Wires and Cables

FOR MORE TONS PER MACHINE PER DAY!

General Electric Geoprene portable cable is constructed with a neoprene-based jacket. We know of no tougher, more abrasion-resistant cable jacket. It is highly resistant to oils, acids, alkalies, sunlight, and flame. Try it! Be convinced by your own first-hand experience that you'll get more miles, more hours, more tons of service from a G-E Geoprene cable.

General Electric makes a full line of wires and cables for the mining industry in addition to portable cable, including such cables as varnished-cambric insulated, Super Coronol*, wire-armored, interlocked armor, aerial cables, Flamenol* control wire, magnet wire, and mine telephone cable. A 24-page booklet, *General Electric Wire and Cable for the Mining Industry*, is yours for the asking. Section W17-295, Construction Materials Division, General Electric Company, Bridgeport 2, Connecticut.

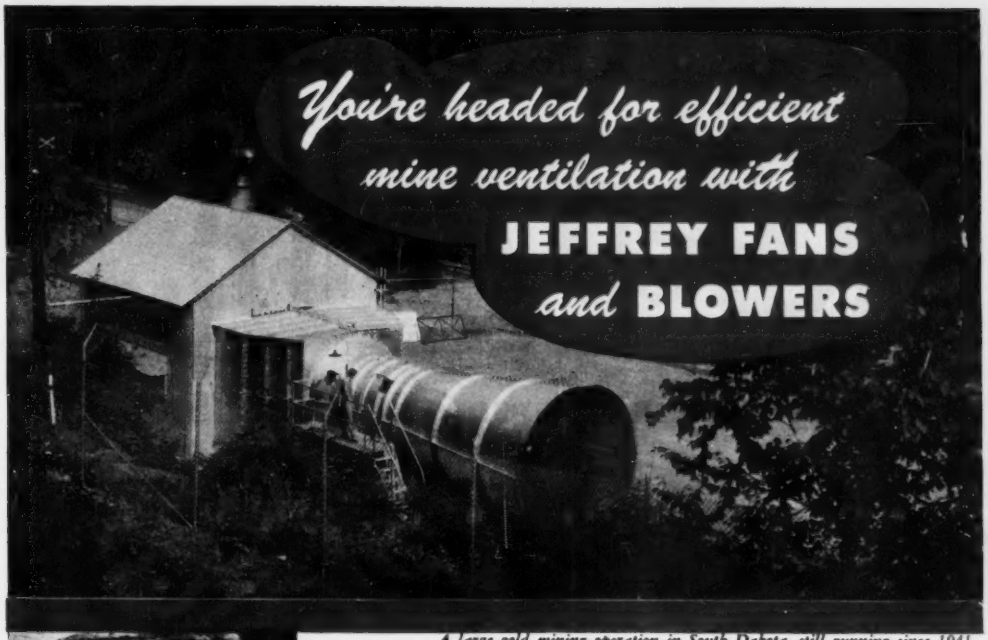
*Registered Trade-mark of General Electric Company

You can put your confidence in—

GENERAL ELECTRIC

You're headed for efficient mine ventilation with

JEFFREY FANS *and* **BLOWERS**



A large gold mining operation in South Dakota, still running since 1941

JEFFREY *Aerodyne*
MIDGET BLOWER

This streamlined, sturdy, portable blower is designed especially for blowing fresh air to the dead end of an entry or similar place through flexible tubing. Illustrated is a Midget Blower serving a Potash mine.

● Fresh air underground is essential. The men working down under know it . . . so do Jeffrey Engineers whose business it is to see that our fans deliver an abundance of fresh air to all underground working places at all times.

Ease of blade adjustment is one of the important features of the Jeffrey Aerodyne Fan. The rotor assembly provides 12 blades designed for individual adjustment. Positive, accurate adjustment is made by removing one set screw in each blade, rotating the blade to desired position and resetting the set screw.

Three types of blades plus ease of adjustment provides an exceptionally wide operating capacity. Each fan is engineered to give best results in your operation. Consult a Jeffrey Engineer on your ventilation problems.

THE **JEFFREY**

Complete line of Material Handling, Processing and Mining Equipment

MANUFACTURING COMPANY Established 1877

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British Jeffrey-Diamond Ltd., Wakefield, England — *Galion (Great Britain) Ltd., Wakefield, England*
Jeffrey-Galion (Pty.) Ltd., Johannesburg, S. A. — *The Ohio Malleable Iron Co., Columbus, Ohio*
The Kilbourne & Jacobs Mfg. Co., Columbus, Ohio

MACK TRUCKS

Keep Pace...

WITH YOUR STEPPED-UP PRODUCTION

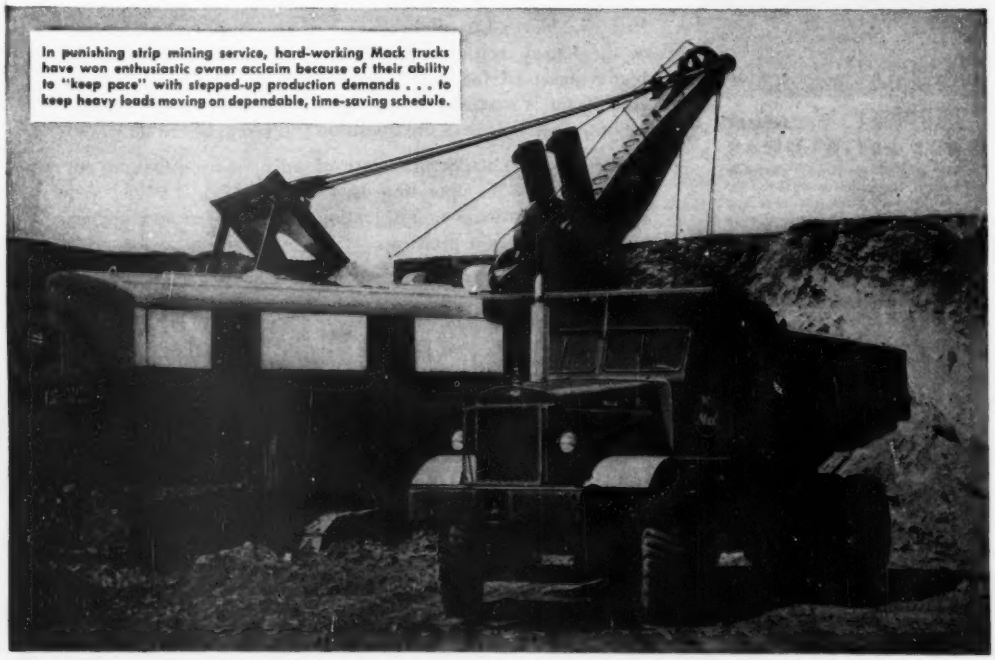
Today's conditions call for trucks that can keep pace with accelerated production schedules. More and more truck owners are realizing that trucks are really "Tools of production"... that intensified service makes doubly important the extra durability and sustained reliability they get from hard-working Macks.

Make sure *your* truck equipment measures up to the rigors of present-day demands. See your nearest Mack branch or distributor for the right truck for your particular job. Prove to your own satisfaction that "Built Like A Mack" means uninterrupted production... extra long life... more tonnage moved at lower cost for many years to come.

Mack TRUCKS

outlast them all

Mack Trucks, Empire State Building, New York 1, N. Y. Factory branches and distributors in all principal cities for service and parts. In Canada: Mack Trucks of Canada, Ltd.



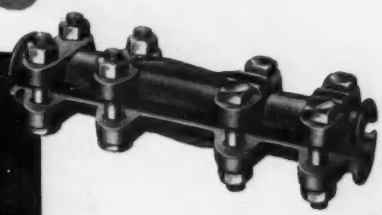
In punishing strip mining service, hard-working Mack trucks have won enthusiastic owner acclaim because of their ability to "keep pace" with stepped-up production demands . . . to keep heavy loads moving on dependable, time-saving schedule.

READY NOW!

Combination feeder and trolley wire clamp

Feeder suspension

Feeder sling



Feeder splicing clamp

ELRECO FITTINGS
for large-diameter ALUMINUM FEEDER

Fittings especially designed to accommodate bare aluminum mine feeder are available now!

The complete line of Elreco fittings can be used for bare aluminum up to 1,590,000 CM (equivalent to 1,000,000 CM copper).

Elreco also manufactures other combination clamps for use in low roof operations, quick-break switches, strain clamps and many more fittings suitable for aluminum conductor.

Write today for price and delivery information on the fittings you need. Tell us your copper sizes . . . we'll translate into aluminum equivalents. Address me personally c/o Elreco, 2901 Cormany Ave., Cincinnati 25, Ohio.

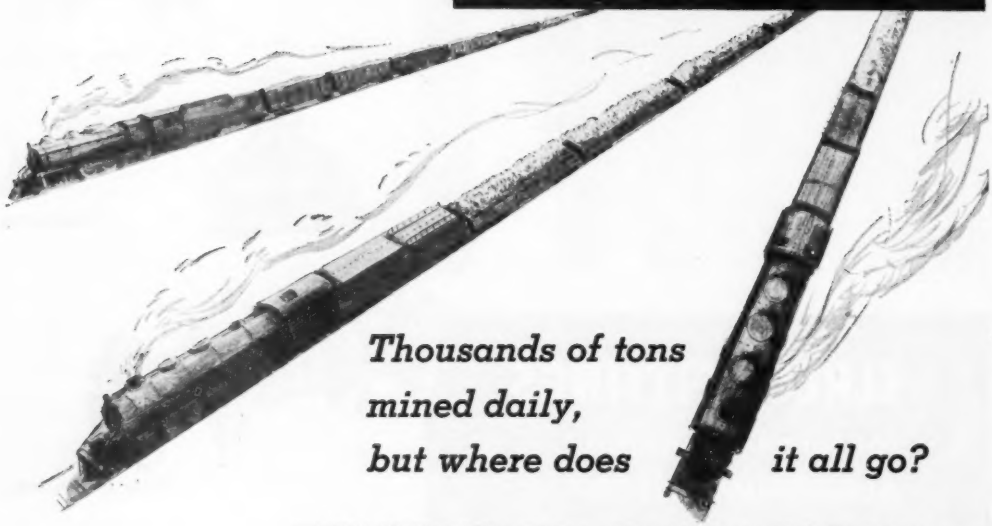
E. K. Meeker
PRESIDENT

Since 1892.

THE ELRECO CORPORATION

A COMPLETE LINE OF TROLLEY MATERIAL FOR EVERY MINE.

Sulphur



Thousands of tons mined daily, but where does it all go?

LOOK AROUND YOU and let your glance fall on any object. The chances are 1000 to 1 that sulphur played an important role in its manufacture, either as a component part of the finished product or as a processing element.

Take, for example, the very magazine you are reading. If it's average size it weighs about 1 pound. Made largely of sulphite pulp it required about 0.1 pounds of sulphur in its manufacture.

Multiply this 0.1 pounds of sulphur by the thousands of magazines turned out every day and you'll get some idea of the tremendous tonnage of sulphur required for this *single* division of industry . . . the sulphite pulp manufacture.

Sulphur has long been called One of the Four Pillars of Industry. Today's need emphasizes this fact more than ever. Sulphur producers are making every effort to get maximum production from existing mines and to develop new sources of sulphur as quickly as possible.

Texas Gulf Sulphur Co.

75 East 45th Street, New York 17, N. Y.

Mines: Newgulf and Moss Bluff, Texas

they're
custom-built
to fit the job!

Work boats, pleasure craft

Drilling rigs, centrifugal pumps, generator sets

Earthmovers, logging yarders and loaders

Buses and highway trucks

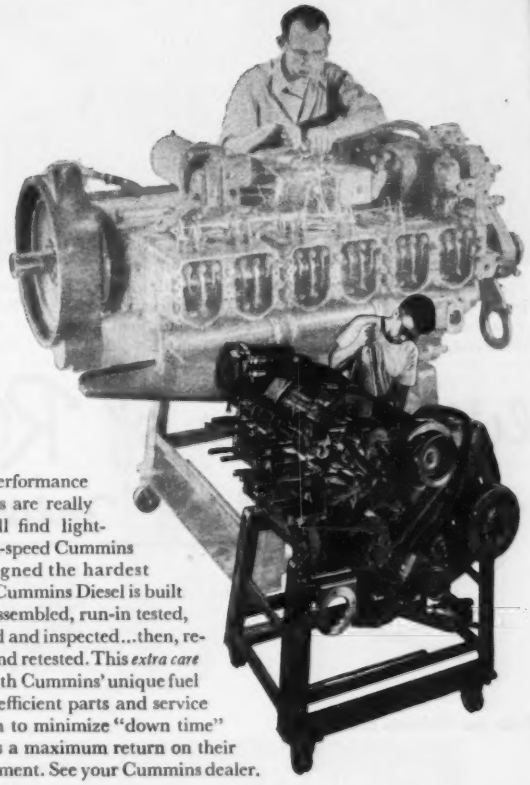
Off-highway trucks, crawler tractors

Shovels, cranes, industrial locomotives and switchers

Lightweight, high-speed Diesels (50-550 hp) for these and many other uses

Cummins® Diesels
do so many jobs so much better

they're
BUILT NOT ONCE BUT TWICE



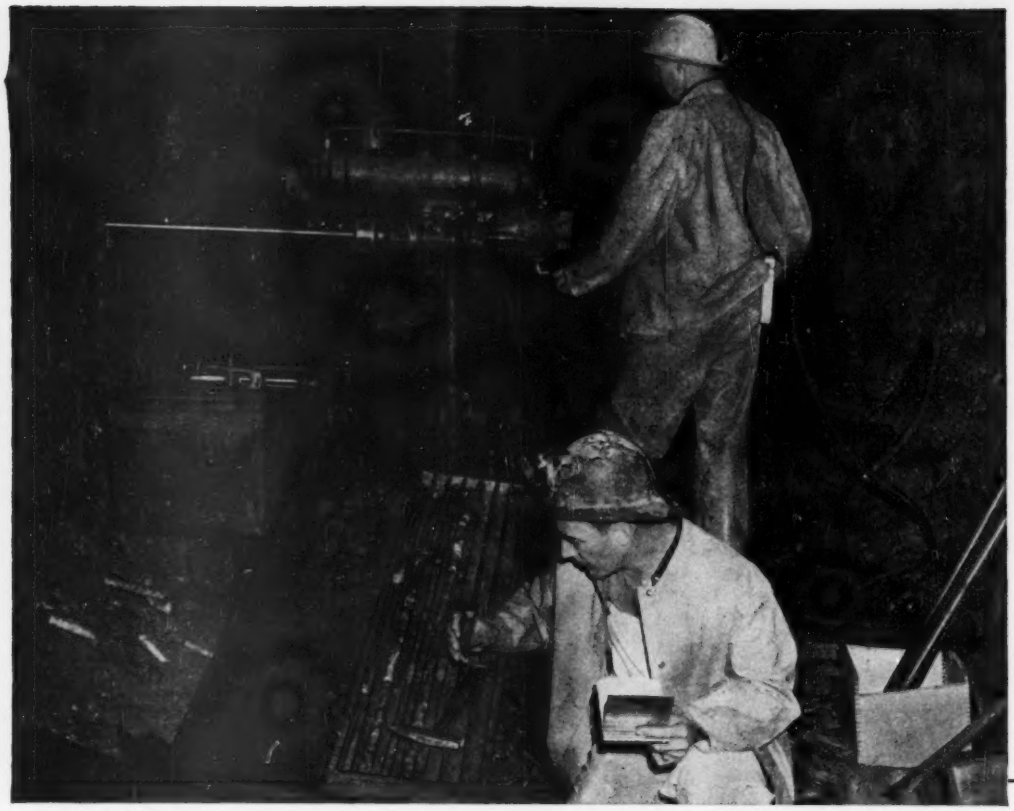
Wherever performance requirements are really rough, you'll find lightweight, high-speed Cummins Diesels assigned the hardest jobs. Every Cummins Diesel is built *TWICE*—assembled, run-in tested, disassembled and inspected...then, reassembled and retested. This *extra care* combines with Cummins' unique fuel system and efficient parts and service organization to minimize "down time" ...give users a maximum return on their diesel investment. See your Cummins dealer.

CUMMINS Diesels DIESEL

TRADEMARK REG. U.S. PAT. OFF.

Diesel power by CUMMINS

CUMMINS ENGINE COMPANY, INC., COLUMBUS, INDIANA
Export: Cummins Diesel Export Corporation • Columbus, Indiana, U.S.A. • Cable: Cumdiex



For blast hole and exploratory drilling, the air-driven CP No. 55 DIAMOND CORE DRILL has the most powerful vane-type air motor ever built into a diamond drill. Conservatively rated at 500 feet with E Rods and EX Fittings. Sensitive control assures low bit cost and high core recovery. Self-aligning rod puller available.

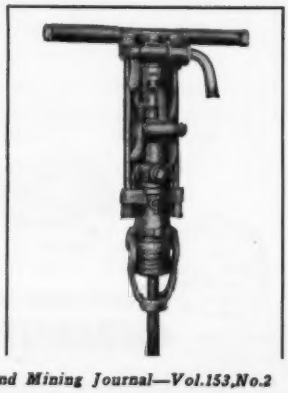
For larger holes, or difficult drilling conditions, the CP No. 55A has high torque with relatively slow spindle speed.

every type of ROCK DRILL for low-cost mining

Write for Bulletin 852

Chicago Pneumatic's complete line of SINKER DRILLS, for dry or wet drilling, ranges from the conveniently light CP-22 (28-pound) and the general utility CP-32 (45-pound) to the heavy-duty CP-60N spring handle sinker (119-pound).

With its exceptional drilling speed, strong rotation, powerful air blow, and excellent riding qualities, the CP-59 outperforms any other drill in the 55-pound class. Because of its 4-in-1 backhead, changeovers from plain dry, blower dry, plain wet or air-wet operation, are easy, rapid and inexpensive to make.

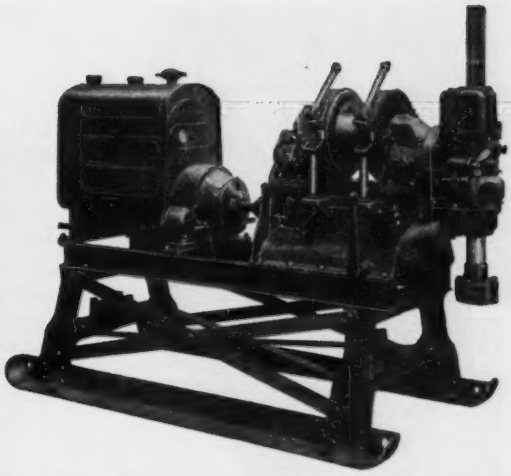


To assure maximum footage from tungsten-carbide bits, the CP-34 STOPER has just the right combination of piston speed, foot-pound blow, rotating speed and feed-leg pressure—plus excellent balance.

For particularly hard, abrasive formations, and the toughest drilling conditions, the CP-44 STOPER is recommended.

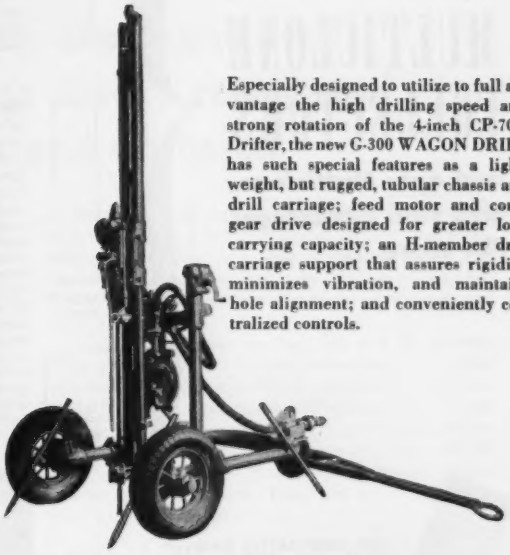
The compact design of CP ROTORdrifters, CP-50N and CP-60N — made possible by having rotary feed motor built into the drill between backhead and drifter cylinder — makes them particularly efficient for operating in close quarters. This construction also eliminates the need for a second air hose. Drill and feed controls are located in backhead.

CP MOTORdrifters have the feed motor on the end of the shell and are specifically designed for the longer feeds permissible in large bore tunnels. The CP-50N, CP-60N, and CP-70N give maximum performance under difficult drilling conditions.



For test boring and mineral prospecting, the skid-mounted CP No. 8 DIAMOND CORE DRILL — gasoline, air, electric or Diesel driven — is readily moved from hole to hole under its own power. With E-EX Fittings these models have a capacity from 900 to 1250 feet.

For deeper drilling, the CP No. 15 with E-EX Fittings has a capacity of 2250 feet. Drilling at the continuous high speed made possible by bortz bits, these Diamond Core Drills give an exceptional performance with low maintenance.

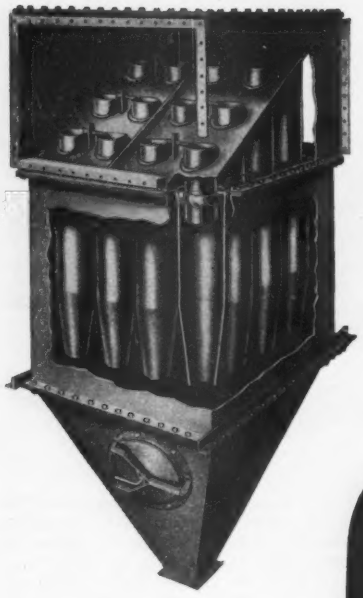


Especially designed to utilize to full advantage the high drilling speed and strong rotation of the 4-inch CP-70N Drifter, the new G-300 WAGON DRILL has such special features as a lightweight, but rugged, tubular chassis and drill carriage; feed motor and cone-gear drive designed for greater load carrying capacity; an H-member drill carriage support that assures rigidity, minimizes vibration, and maintains hole alignment; and conveniently centralized controls.

CHICAGO PNEUMATIC TOOL COMPANY

General Offices: 8 East 44th Street, New York 17, N. Y.

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES
ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES



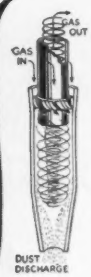
In dust and fly ash recovery

MULTICLONE COLLECTORS

***and only Multiclones* give vital advantages like these...**

No wonder "MULTICLONE" is the leading name in the centrifugal recovery of dust and fly ash from all types of gases, hot or cold.

No other mechanical recovery equipment has so many years of dust and fly ash recovery experience behind it... or has such uniformly high collecting efficiency... or provides so many other money-saving, space-saving advantages as MULTICLONE. The four advantages outlined below are by no means the complete MULTICLONE story, but are typical of the vital savings found *exclusively* in MULTICLONE equipment...



Uniformly High Recovery:

MULTICLONE's multiple *small diameter* tubes—made possible by its exclusive vane design—whirl the dirty gases with greater centrifugal force, thus throwing out not only the large, medium and small particles, but also a high percentage of the *extremely small* particles of 10 microns and less. This, coupled with the fact that there are no pads or filters to become choked with recovered material, results in a more complete recovery of *all* suspended materials from the gas stream.

Long and narrow

Square

Maximum Adaptability:

In addition to its unusual compactness, the MULTICLONE is also unusually adaptable to various installation requirements. Where head room is low it can be installed with side-inlet side-outlet connections. Where side clearances are restricted, it can be installed with side-inlet top-outlet connections. In addition, without changing capacities, the shape of the unit can be varied—long and narrow, short and wide, or square—to fit restricted spaces ... and its single-inlet single-outlet duct requirements permit greater flexibility and simpler installation. These savings slice installation costs, space requirements and insulating expense.

Space-Saving Compactness:

Plant space costs money—so be sure to check space requirements carefully. As shown in the accompanying chart, the MULTICLONE requires less floor space and less cubic space than any other unit of comparable capacity and performance. Translate these savings into today's high costs for plant space and you readily see the great importance of this one MULTICLONE advantage alone!

Make	Relative Space Requirements In Sq. Ft.	In Cu. Ft.
Multiclone	1.0	1.0
Collector A	2.1	1.8
Collector B	5.9	3.2
Collector C	6.8	3.9

Minimum Maintenance:

The MULTICLONE has no high speed moving parts to repair or replace... no pads or filters to clean or renew... nothing to choke the gas flow or increase draft losses as suspended materials are recovered. MULTICLONE draft losses remain uniformly low *at all times*. Further, the recovered material from an entire bank of tubes is collected in a *single* hopper—far easier to service and maintain than the multiple hoppers of conventional cyclone units.

FREE INFORMATIVE BOOKLET
This 32 page booklet outlines the basic principles of centrifugal dust recovery and shows the many ways MULTICLONE advantages assure higher recovery at lower overall costs. A free copy of this booklet will gladly be sent on request. Write today!

Before you decide on any recovery equipment be sure to get complete information on MULTICLONE advantages. A letter, wire or phone call to our nearest office places this information in your hands without obligation. Get all the facts and you will get MULTICLONE Collectors!

WESTERN Precipitation CORPORATION

ENGINEERS, DESIGNERS & MANUFACTURERS OF EQUIPMENT FOR COLLECTION OF SUSPENDED MATERIALS FROM GASES & LIQUIDS

Main Offices: 1012 WEST NINTH STREET, LOS ANGELES 15, CALIFORNIA
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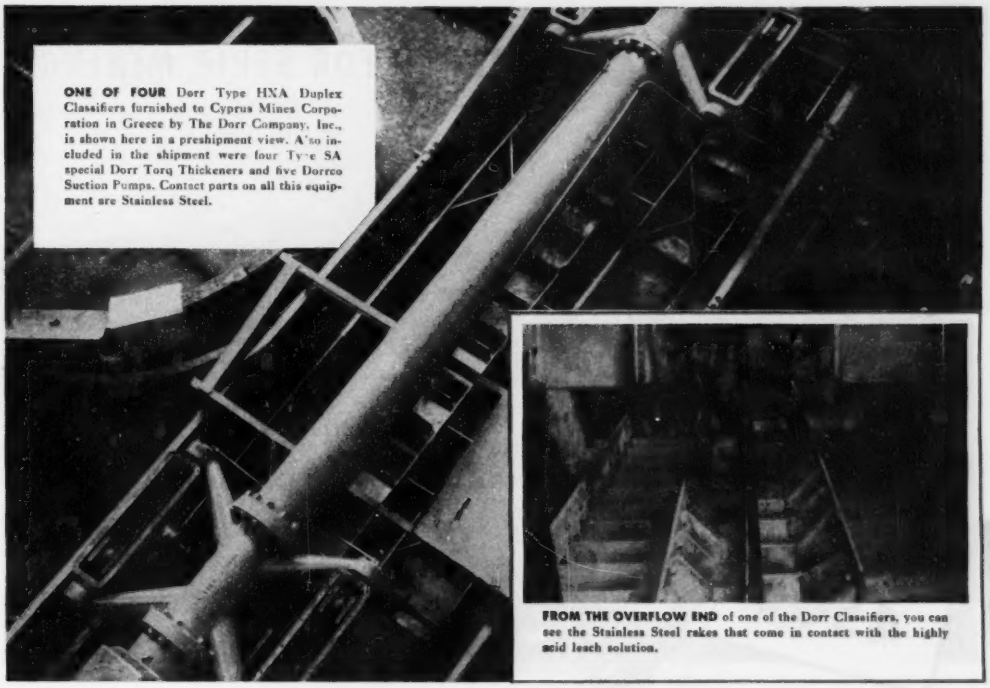
PRECIPITATION CO. OF CANADA, LTD., DOMINION SQ. BLDG., MONTREAL



ONE OF FOUR Dorr Type HXA Duplex Classifiers furnished to Cyprus Mines Corporation in Greece by The Dorr Company, Inc., is shown here in a preshipment view. Also included in the shipment were four Type SA special Dorr Torq Thickeners and five Dorrco Suction Pumps. Contact parts on all this equipment are Stainless Steel.

FROM THE OVERFLOW END of one of the Dorr Classifiers, you can see the Stainless Steel rakes that come in contact with the highly acid leach solution.

For acid leaching of copper ore, you need Stainless Steel's resistance to corrosion and abrasion

With today's emphasis on more and more metal production, little-used methods of ore recovery are getting careful attention. Many of them, like acid leaching of oxidized copper ore, put heavy demands on equipment . . . demands that can be best met with corrosion-resisting, abrasion-resisting U·S·S Stainless Steel.

In order to improve the metallurgical recovery of copper from their ores, Cyprus Mines Corporation in far-off Greece is acid leaching oxide copper and brightening copper sulphide materials ahead of flotation. For this job, all contact parts in the leaching equipment, including Dorr Thickeners, Classifiers and Suction Pumps, are made of Stainless Steel to resist the sulphuric acid leach solution.

Stainless Steel combines its exceptional corrosion resistance with a tough, durable surface that withstands day-in, day-out wear and abrasion. In one material, it gives you the answer to two of the mining industry's most severe problems—corrosion and abrasion.

When you consider its long life and its freedom from costly maintenance and shutdowns, you'll find Stainless the most economical material you can use.

And you'll get the finest performance from Stainless equipment when it is built of perfected, service-tested U·S·S Stainless Steel. Our engineers will be glad to tell you more about the properties of various grades of U·S·S Stainless Steel and how they will fit into your equipment picture.

U·S·S STAINLESS STEEL

AMERICAN STEEL & WIRE . . . . COLUMBIA-GENEVA STEEL . . . . NATIONAL TUBE . . . . TENNESSEE COAL & IRON

UNITED STATES STEEL SUPPLY, WAREHOUSE DISTRIBUTORS . . . . Divisions of **UNITED STATES STEEL COMPANY, PITTSBURGH**

UNITED STATES STEEL EXPORT COMPANY, NEW YORK

2-360

UNITED STATES STEEL

REACH....

More and more of the leading strip operators and contractors are switching to the big, powerful Manitowoc 4500. It's the real sensation of the mining industry . . . sensational in design and performance. As a shovel, it ranges from 4 yds. on a 60′ boom, 5 yds. on a 50′ boom, 5½ yds. on a 40′ boom. As a dragline, it ranges up to a 140′ boom. And there's power-a-plenty in its rugged 375 H.P. Diesel.

STABILITY...POWER

It's packed with extra features . . . fewer gears, all enclosed running in oil; high speed shafts on ball or roller bearings; simple, independent cable crowd; single, tubular stick rolls through saddle but is free to turn. Ships on standard flat cars with minimum dismantling. Unload and erect in 3 to 5 days.

MANITOWOC
SHOVELS
1-5 YD.
MANITOWOC
Speedcrane
CRANES
18-100 TON
WISCONSIN

ANSWER:

CONSULT THE MAKER OF ALL TYPES

for an unbiased recommendation

PHILLIE GEAR

When you get a recommendation from Philadelphia for the application of a speed reducer to fit your drive you can be sure it is the *best* type unit you can get for that need. We make *all types and sizes* so our recommendations are not biased through a limited selection but are absolutely impartial.

Thousands of Philadelphia Speed Reducers are transmitting power dependably and economically in all lines of industry and in all parts of the world. As a result, we have gained a thorough understanding of industry's varied drive requirements. That experience has been applied to the design and construction of all our speed reducers and is a fundamental reason for the continuing preference for Philadelphia products.

OUR 60TH ANNIVERSARY

Whatever your power transmission problem it will pay you to talk it over with Philadelphia.

Catalogs are available on each type Philadelphia Speed Reducer, GearMotor and MotoReduceR. Write on your business letterhead and ask for the one you need.

Shown counterclockwise above—Herringbone, Planetary, Spiral Bevel, Worm Gear Reducers, Speed Increaser, GearMotor, Vertical MotoReduceR, Steeple Type Worm Reducer.

Philadelphia Gear Works, INC.

ERIE AVE. AND G ST., PHILADELPHIA 34, PA.

NEW YORK • PITTSBURGH • CHICAGO • HOUSTON • LYNCHBURG, VA.

IN CANADA: WILLIAM AND J. G. GREEY LIMITED, TORONTO

Industrial Gears and Speed Reducers
LimiTorque Valve Controls

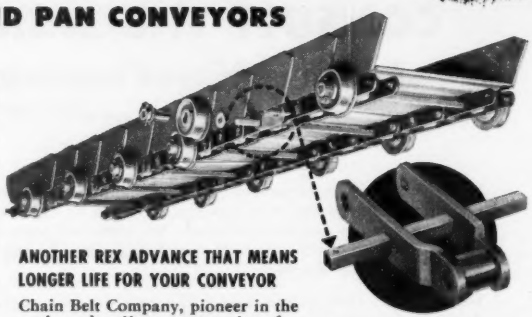
HOT STUFF

IS EASY WITH REX® APRON AND PAN CONVEYORS

When it comes to transporting hot bulk materials, there is virtually no upper limit to the temperatures the rugged, heavy-duty Rex Apron and Pan Conveyors can stand. Several now in operation are handling material up to 1900° F. Hot sinter, hot clinkers, hot lime, hot castings—these and many other "hot" items are all in a day's work with Rex Apron and Pan Conveyors.

Rex Conveyors will handle jobs where other types such as shaker conveyors and steel belts are useless. They have high capacity, require very little maintenance and operate at very low cost. Wearing parts are specially hardened. Chain is located away from high heat zone. Graphite impregnated grease is used throughout. When heat softens grease so that it flows, graphite remains to do lubricating job. With Rex, you are free from worry about premature failure and consequent costly down time or repairs.

For all the details write to Chain Belt Company, 4679 W. Greenfield Ave., Milwaukee 1, Wis.



ANOTHER REX ADVANCE THAT MEANS LONGER LIFE FOR YOUR CONVEYOR

Chain Belt Company, pioneer in the outboard roller construction for apron and pan conveyors, has now developed another new feature which can add years to the life of your conveyor—the square through rod. This exclusive Rex feature makes it impossible for the rod to rotate in the side plate. This means longer life for your conveyor *3 ways:*

1. Through rod breakage is eliminated
2. Side bar failure due to enlargement of attachment holes is eliminated
3. Bushing life is greatly lengthened.

CHAIN BELT REX COMPANY ®

Chain Belt COMPANY OF MILWAUKEE

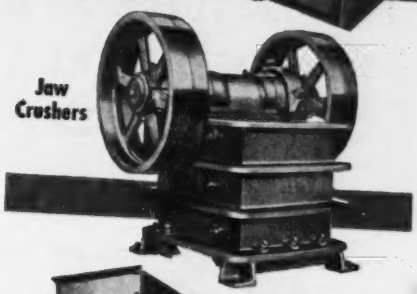
Atlanta • Birmingham • Boston • Buffalo • Chicago • Cincinnati • Cleveland
Dallas • Denver • Detroit • El Paso • Houston • Indianapolis • Jacksonville
Kansas City • Los Angeles • Louisville • Midland, Texas • Milwaukee • Minneapolis
New York • Philadelphia • Pittsburgh • Portland, Oregon • Springfield, Mass. • St. Louis • Salt Lake City • San Francisco • Seattle • Tulsa • Worcester

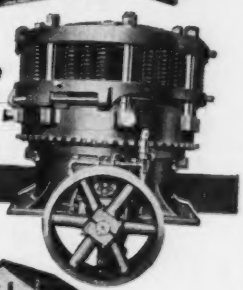
Distributors in all principal cities in the United States and abroad

TELSMITH

feeding
coarse crushing
screening
fine crushing

EQUIPMENT FOR MINES





Find out HOW You can get Top Tonnage at Lower Cost Per Ton . . . Consult Telsmith Engineers. Send for Bulletin 266.

Min. 33

SMITH ENGINEERING WORKS, 502 EAST CAPITOL DRIVE, MILWAUKEE 12, WISCONSIN

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Mines Eng. & Expt. Co., San Francisco 4, Calif.
Mussens Canada Ltd., Montreal, P.Q.
Gordon Russell, Ltd., Vancouver, B. C.

Steel

BULWARK OF FREEDOM, BUT . . .
THE STEEL INDUSTRY
NEEDS YOUR HELP

Blast furnaces are today operating at capacity.

The product of a blast furnace is pig iron.

The only substitute for pig iron is scrap. The only way to maintain present steel production, or to increase steel production, is to find more scrap.

All industry has it within its power to provide extra scrap by abandoning and "scrapping" obsolete units. Extra scrap has been provided through this means in scores of plants throughout the nation.

Have you done so in your plant or shop? Every ton of scrap you provide at this time will mean an extra ton of steel which you may need.

Action now, however, is important. Don't leave it to the other fellow. Will you inaugurate a search for obsolete equipment and scrap in your shop?

The entire steel industry will appreciate your cooperation.

SHEFFIELD
STEEL
CORPORATION
HOUSTON KANSAS CITY
TULSA
SUBSIDIARY OF ARMCO STEEL CORPORATION

EVERY TON OF SCRAP
RECEIVED BY SHEFFIELD
WILL MEAN MORE OF
THE FOLLOWING PRODUCTS

Plates, Sheets, Merchant Bars, Structural Shapes, Steel Joists, Reinforcing Bars, Welded Wire Mesh, Wire Rods, Fence, Barbed Wire, Spring Wire, Nails, and other Wire Products, Rivets, Grinding Media, Forgings, Track Spikes, Bolt and Nut Products.

NOTES FROM THE PUMP ENGINEER'S HANDBOOK

Impeller clearance adjustment made at surface.
Motor at surface eliminates fire and flooding hazards. Can be engine driven.
Annealed shafting protected with stainless steel sleeve at bearings.
Vitreous porcelain-lined bowls and impellers for abrasives.

BORE HOLE PUMPS for Mine Dewatering

Johnston mine dewatering pumps are designed with special alloys or protective coatings as required by the abrasive or corrosive qualities of the mine water. Either deepwell type for bore hole or shaft installation, or short-coupled units for sumps are available. With submerged bowls, no priming apparatus is necessary. Ideal for automatic or remote operation. With complete information about fluid to be pumped and the service requirements, our Engineering Department will gladly submit typical design drawings and specifications.

SHAFT WEAR CAN'T HAPPEN to a Johnston Water-Lubricated Pump!

Here's another QUALITY feature that makes Johnston Water-Lubricated Turbine Pumps a good investment. The renewable stainless steel sleeves which shroud the line-shaft at all points of bearing contact make it impossible for sand or other abrasives to damage the shaft. Sure, the sleeve and bearings wear on a Johnston just like they do on any pump . . . but think of the savings on parts and labor alone when you simply replace a sleeve instead of a complete section of shafting. What's more, you don't need a lot of special tools to do the job! Do it at the pump site . . . just unscrew the old sleeve and thread on the new!!!

LITTLE DETAILS LIKE THE RENEWABLE SHAFT SLEEVE MAKE JOHNSTON PUMPS BETTER!!!

Trained hydraulic engineers are available at your nearest Johnston Dealer or at the Johnston factory to furnish detailed information, proposals and anything else necessary to meet your particular pumping equipment needs.

THERE'S A JOHNSTON PUMP FOR EVERY PURPOSE

Sizes range from 4 to 32 inches; single- or multi-stage; 2 to 1000 H.P.; capacities to 10,000 G.P.M.; lifts to 1000 feet; for liquid temperatures to 400° F.

JOHNSTON PUMP COMPANY
3272 EAST FOOTHILL BLVD., PASADENA 8, CALIFORNIA

HEADQUARTERS FOR VERTICAL TURBINE, MIXFLOW AND PROPELLER PUMPS SINCE 1909

DINGS magnetic equipment for every mining requirement!

Dings Rectangular Electromagnet provides maximum iron removal above belts or chutes. Triple pole design for great magnetic strength and depth of penetration. Maximum magnetic strength across entire magnet face. Easily installed in any position. Low operating cost . . . trouble free . . . complete range of sizes.

(Right) Induced Roll Separator purifying sand.

Battery of Crockett Separators concentrating magnetite. (Left)

Magnetic Detector signals presence of tramp iron. (Right)

NEW, powerful Cross Belt Separator — with higher selectivity—for concentration and purification *(Above)*

NEW, *powerful, non-electric Alnico Perma-Pulley for purifying, cobbing, protecting crushers, pulverisers, etc. Magnetic permanence guaranteed for life of installation.* **(Above)**

Wherever crushers must be protected against tramp iron, wherever magnetic separation can contribute to the beneficiation of ores, you will find Dings magnetic separators specially designed to meet the requirements of the job. Dings magnetic separators have played an important role in making the extraction of many minerals possible and economically feasible. Shown here are a few of the machines which Dings has pioneered exclusively for the mining industry for the following purposes:

CONCENTRATION—everything from specially designed pulleys for cobbing nickel ores to powerful induced roll and cross belt separators for concentrating manganese, tungsten, chrome, titanium and many other minerals.

PURIFICATION—removing small amounts of feebly magnetic impurities with super high intensity separators. Minerals treated include feldspar, silica sand, salt, bauxite, barytes, nepheline-synenite, gypsum.

CRUSHER PROTECTION—magnetic pulleys, pulley type separators, drums, suspension magnets, spout magnets and magnetic detectors are all widely applied for arresting tramp iron ahead of crushing equipment.

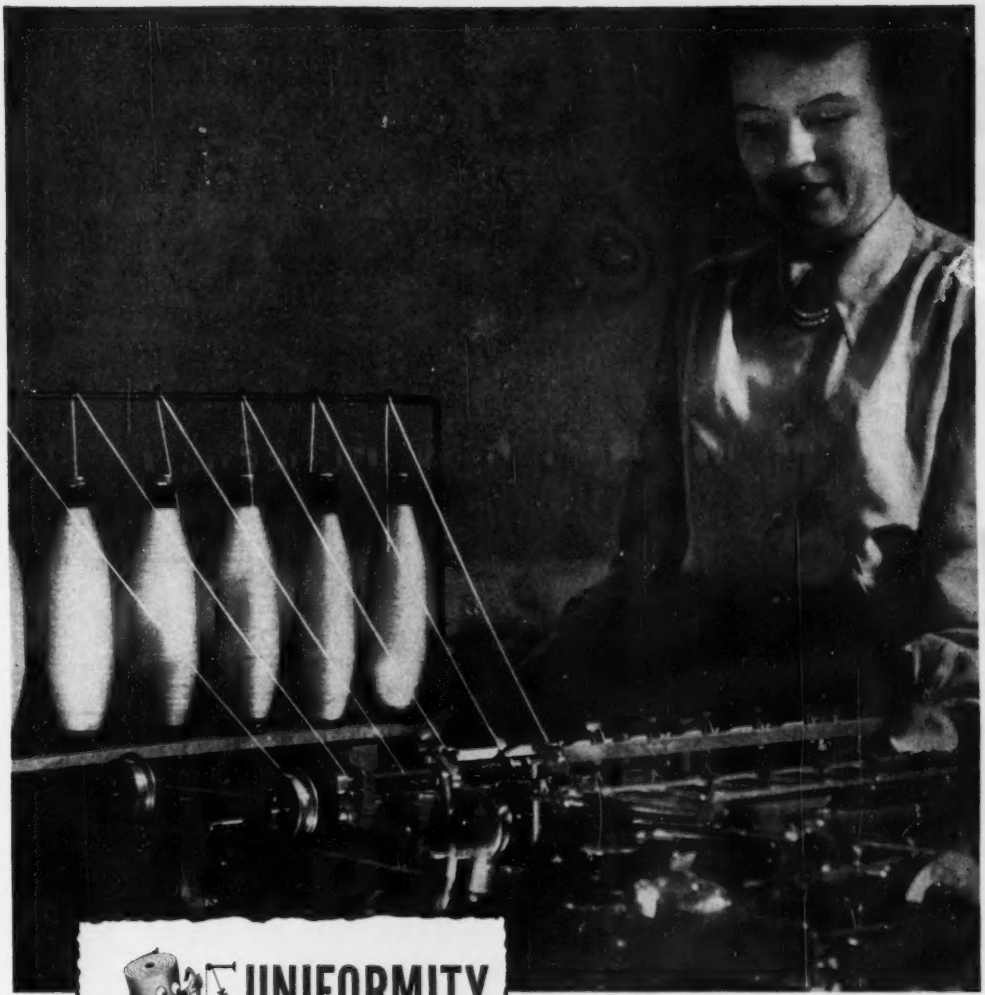
WET TYPE SEPARATORS—Dings has pioneered in the development of wet type separators for concentrating magnetite and for use in new processes for concentrating low grade ores. *Ask for complete details of Dings Separators for Heavy Media Process Plants.*

Take advantage of Dings equipment and experience. For practical recommendations, submit your requirements with 25 lb. samples of material to the Dings Laboratory for testing and analysis. Literature on request.

DINGS MAGNETIC SEPARATOR CO.
6716 W. ELECTRIC AVENUE, MILWAUKEE 46, WISCONSIN

"Magnetic Separation Headquarters Since 1899"

Dings
"HIGH INTENSITY"



UNIFORMITY

Makes the Big Difference

In FILTER Fabrics

MT. VERNON EXTRA Gives You Greater Fabric Uniformity

Shown above is one of a series of comprehensive laboratory controls throughout production to assure uniformity in all Mt. Vernon-Woodberry products. The unit shown automatically tests 6 strands of yarn at one time.

Mt. Vernon-Woodberry Mills

Branch Offices: Chicago • Atlanta • Baltimore • Boston • Los Angeles

TURNER HALSEY COMPANY
Selling Agents
40 WORTH ST. NEW YORK

Uninterrupted Conveyer Service With Slo-Speed

Severest weather conditions have not affected in any way the Slo-Speed motor driving our 250-ft. outdoor inclined belt conveyor which is in constant use up to 14 hours per day, reports Gene Herbst, Vice-President, Central Concrete Co., St. Louis. We attribute this uninterrupted service to rugged construction and Sterling's protected drip-proof design.

STERLING SLO-SPEED

GIVES YOU THE ONE BEST LOW SPEED AND

gives uninterrupted service — carries heavy overhung loads — provides versatile mounting and flexibility in arrangement of machinery — saves valuable space — provides greater safety — costs less to install and use. An indispensable source of low speed power for:

Agitators	Dryers	Presses
Blenders	Feeders	Pumps
Blowers	Kilns	Screens
Conveyors	Mills	Tumblers
Cookers	Mixers	Etc., etc.

70 ILLUSTRATIONS showing how Sterling Electric Power Drives reduce production costs. Write for Bulletin No. C-124.

STERLING
ELECTRIC MOTORS

Plants: New York City 51; Van Wert, Ohio; Los Angeles 22; Hamilton, Canada; Santiago, Chile
Offices and distributors in all principal cities

KENNAMETAL *Inc.*
BUYS TUNGSTEN CONCENTRATES

COBALT • COLUMBITE • TANTALITE

Prompt, businesslike settlement by private tungsten user and dealer secures you the best results. Cash advance against shipments. Scheelite, wolframite, hübnerite, ferberite, and cuproscheelite concentrates, middlings, and ores 20% to 60% WO_3 or higher purchased. Superior refining processes enable us to utilize lower-grade products and thus to minimize penalties.

Offers received at the nearest division of Kennametal Inc. Write, telegraph, or phone:

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  Pacific Northwest Exploration & Mining Div. of Kennametal Inc.
  609 Colman Building
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  c/o Kennametal of Canada Ltd.
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  Latrobe, Pa., U.S.A.

KENNAMETAL *Inc.*, Latrobe, Pa.
MANUFACTURERS OF SUPERIOR CEMENTED CARBIDES

HARDHED

Diamond DRILL BITS

J. K. Smit manufactures the largest variety of diamond bits to give you the lowest cost per foot under all drilling conditions.

HARDHED matrix for the usual drilling conditions.

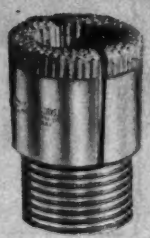
HARDHED "40" matrix for abrasive conditions.

HARDHED "50" matrix for extremely difficult drilling conditions such as badly broken, hard formations.

FERRET impregnated bits where this type gives better performance than surface set whole stone bits.

J. K. Smit engineers welcome the opportunity to discuss your drilling problems. Special equipment can be made to meet any unusual conditions.

Prompt Delivery • Precise Resetting Service



J. K. SMIT & SONS
General Offices and Plant: Murray Hill, N. J.

J. K. SMIT & SONS of MICHIGAN
J. K. SMIT & SONS of CANADA

P&M ONE PASS BITS

with Waterland and Padley & Morgan patented features

largest selling bit in the world . . .

Hayes

This is the bit with the simplest possible type of connection. It depends on a differential angle between the skirt on the bit and the angle of taper on the shank, coupled with an accurate ratio between the depth of socket and its diameter. Three other features — Flattened Points — Offset Gauge — Thinner Wings, contribute to the faster, lower cost operation of the Hayes P & M bit. Used in 26 countries — 50 million a year in one country alone, the P & M bit is one you should try. *Write for Bulletin 741.*

HAYES STEEL PRODUCTS LIMITED • MERRITTON, CANADA

Representatives: Industrial & Commercial Supply Company, 544 Powell St., Vancouver, B. C.; General Sales & Equipment Co. Limited, 395 Main St., Winnipeg, Manitoba; Mr. George MacLeod, Noranda, Quebec; Construction Equipment Co. Limited, 404 Old Weston Road, Toronto, Ontario; Construction Equipment Co. Limited, 180 Vallee St., Montreal, Quebec; Construction Equipment Co. Limited, 135 Lower Water St., Halifax, N. S.; Heap & Partners (Nfld.) Limited, 241 Water St., St. John's, Newfoundland; Thomas M. Nevin y Cia, S. A., Manuel Ma Contreras 58, Mexico, D. F.; Western Machinery Company, N. 808 Division St., Spokane, Washington.

DIGGING FOR PROFITS?

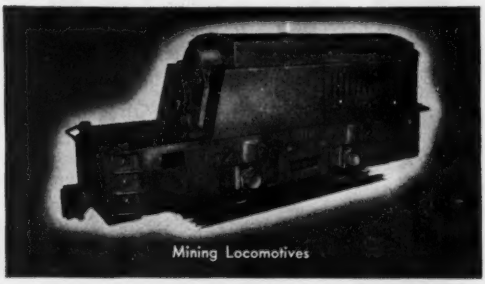
They'll carry the load!

Here's mining equipment designed by men who have solved many difficult mining problems in many different parts of the world . . . mining equipment manufactured by a company with over 50 years' experience in serving the mining industry! Only a few examples of the many types of mine cars manufactured are shown here.

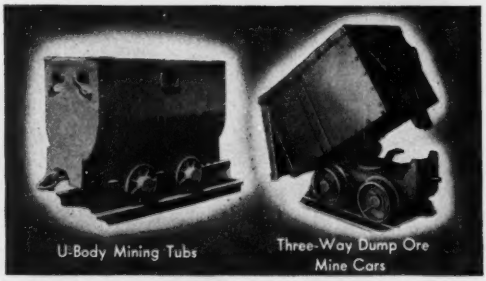
To mining engineers concerned with the increasing costs of mine operation, "Pressed Steel Car Company" equipment will give dependable, efficient, trouble free service.

For constructive help in solving your difficult mining problems consult our engineers.

Spiratube . . . the new flexible tubing for ventilation



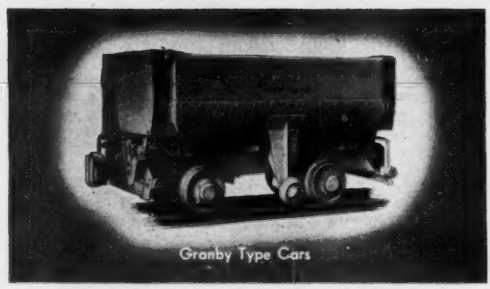
Mining Locomotives



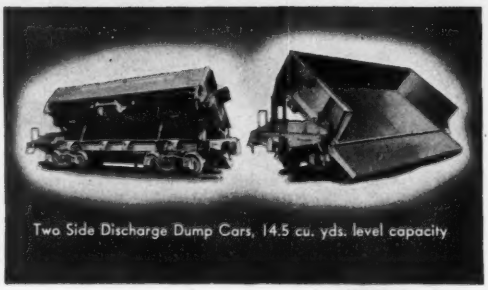
U-Body Mining Tubs

Three-Way Dump Ore Mine Cars

Track work and car parts



Granby Type Cars



Two Side Discharge Dump Cars, 14.5 cu. yds. level capacity

Other Products...

WEST VIRGINIA STEEL and MANUFACTURING CO.
Steel rails, steel crossties, track accessories, switches, crossings, frogs, etc.

THE FATE-ROOT-HEATH COMPANY
Brick manufacturing machinery.

PLYMOUTH LOCOMOTIVE WORKS
Internal combustion motor locomotives from 3 to 70 tons (alcohol, gasoline, Diesel and Diesel-electric).

WOOLERY MACHINE COMPANY
Weed burners, gang cars, rail motor cars.

FLEXIBLE TUBING CORPORATION
Flexible Tubing.

PSC

Steelcar

PRESSED STEEL CAR COMPANY, Inc.

Export Division, 25 Broad Street, New York 4, N. Y.

How do you measure the look in a puppy's eye?

The preliminary precautions have been taken. A well-recommended kennel. A healthy litter. A breed that takes well to youngsters.

Now it's up to the boy to choose.

How will he decide? Perhaps by the look in a puppy's eye.

Chances are, you'll be buying Multiwalls soon again. You've done as every good buyer does. You've considered the reputation of the various suppliers. You've investigated the quality of their product. You've set down your specifications to the last fraction.

Now you pause to think again of the fellow who will make the final choice—your customer. How will he decide? One consideration may well be "the look in a puppy's eye." To say it another way, the sales appeal of your package.

Men who know Multiwalls . . . who buy more than 85 per cent of all Multiwalls made . . . give great weight* to good printing and design.

Union's art directors have concentrated experience. They know how to give your Multiwall package the look it needs to stand out among competition. Volume purchasers of Multiwalls recognize this. They are calling on Union for a greater share of their Multiwall needs.

More so every day . . .

IT'S UNION FOR MULTIWALLS

*August, 1951 research study.

UNION BAG & PAPER CORPORATION • WOOLWORTH BUILDING, NEW YORK 7

Low Cost Concentration

with the

Humphreys Spiral Concentrator

Bridging the gap between Heavy Media and Flotation, the Humphreys Spiral Concentrator provides a low cost method for recovery of values between ⅛" and 200 mesh.

★ *for* **separation of minerals of different specific gravity in ores at sizes generally minus 10 mesh.**

★ *for* **recovery of liberated values too coarse for flotation.**

★ *for* **recovery of other ore values from flotation tailing.**

★ *for* **recovery of values too fine to be economically treated by heavy-media separation.**

★ *for* **cleaning minus ¼ inch bituminous or anthracite coal.**

Low cost of installation
Low operating costs
No moving parts

Concentrating action of Humphreys Spiral—Note wide black band of concentrate entering upper outlet, which is set for a wide cut, also narrow black band of middling entering lower outlet set for thin cut. In cleaning fine coal, phosphate rock and mica, refuse and middling are discharged from the concentrate ports and cleaned product follows the path shown as tailing.

The installation, operation and maintenance costs of Humphreys Spirals are so low that economical concentration of materials, which could not heretofore be worked at a profit, is now possible. There are no moving parts, no vibration, weight per unit of capacity is low and requires only a light foundation. Floor space per ton treated is very small.

HUMPHREYS SPIRALS are widely used in plant operations in the United States and abroad, ranging from 30 tons to 20,000 tons daily capacity, for concentration of fine iron ore; for concentration of chromite, ilmenite, rutile, and zircon from sands; for concentration of ground ores for recovery of lead, zinc, chromite, copper, barite, mica; for concentration of molybdenum flotation mill tailing for recovery of tungsten; for separation of fine phosphate rock from sand; for cleaning minus ¼ inch coal; for concentration of pyrite from flotation mill tailing; for concentration of fine gold and gold bearing minerals.

A testing laboratory is maintained in Denver by the Engineering Division of The Humphreys Investment Company. Results obtainable in a full size plant may be determined by tests of a representative sample of minerals or coal weighing 300-500 pounds.

THE HUMPHREYS INVESTMENT COMPANY
ENGINEERING DIVISION
914 First National Bank Building • Denver 2, Colorado

Manufacturing and Sales Agents
SWEDEN: Sala Maskinfabriks A-B, Sala
AUSTRALIA: John Carruthers & Co. Pty. Ltd., Edgecliff, N.S.W
BOLIVIA: Mauricio Hochchild S.A.M.I., La Paz
SOUTH AFRICA: Edward L. Bateman (Pty.) Ltd., Johannesburg

Barber-Greene

There's a common answer to the problem of moving bulk materials —everything from wet Feldspar to heavy iron ore—in the fastest, most economical way. B-G Belt Conveyors have proved this time and again in numerous underground and surface installations.

And unique among all belt conveyor manufacturers, Barber-Greene offers the benefits of Barber-Greene "pre-engineering." B-G Conveyors come to you as packaged units, clearly marked for simple assembly without extra fabrication and "blueprint" work. See your Barber-Greene distributor.

BARBER-GREENE COMPANY • AURORA, ILLINOIS

Constant Flow Equipment

LOADERS | PERMANENT CONVEYORS | PORTABLE CONVEYORS | COAL MACHINES | BITUMINOUS PLANTS | FINISHERS | DITCHERS

HERE'S WHY

HERCULES FLATTENED STRAND is 10% STRONGER

It Packs More Steel Than Any Other Construction

SEE the keystone shape of the strands? Notice how compactly they fit together? That's the answer. There is *more* steel and *less* fiber in HERCULES Flattened Strand than in any other wire rope construction of equal size. And if you specify wire rope core, you get *still* more strength—7½% more—in the same diameter. That extra strength is often mighty useful—safer, too.

SEE how smoothly it fits the sheaves? Not one—but *four* wires in *each* strand touch the groove. That gives *longer* life to the rope . . . longer life to the sheave, too, because Flattened Strand's smooth outer surface prevents corrugation. And it's Preformed for easy handling.

The Red Strand is always your assurance of wire rope made of the finest steel and to the highest standards LESCHEN has developed in 95 years of rope making.

HERCULES RED STRAND

TOUGH ROPE FOR ROUGH JOBS

"Wire Rope Handbook"

tells why, and where Flattened Strand can best fit into your particular operation. Write for Booklet V-2.

LESCHEN WIRE ROPE

Consult our Engineering Department for specific recommendations. A. LESCHEN & SONS ROPE CO., 5909 Kennerly Ave., St. Louis 12, Missouri. Distributors in all principal cities.

HINGED PLATEGRIP

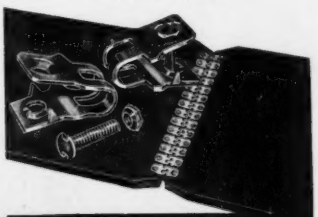
BELT FASTENER No. 500

FOR HEAVY CONVEYOR BELTS OF CHANGING LENGTH

These heavy-duty belt fasteners make a strong, flexible joint in conveyor belts, belts of any width and of from 3/16" to ½" thickness. They offer special advantages in mines, quarries or industrial setups where length or position of belt is frequently changed, because sections can be removed or added at will. Joints are opened for this purpose by simply pulling out the hinge pin.

Easily and quickly applied on the job or in the shop. Special design gives deep compression into belting and smooth, flush joint.

Write for Circular.

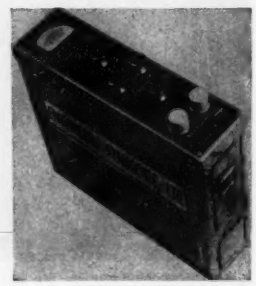


ARMSTRONG-BRAY & CO.
5364 Northwest Highway · CHICAGO 30, U. S. A.

CAN YOU AFFORD TO BE WITHOUT THE

Scintillometer

LOCATE URANIUM 100 TIMES EASIER. THE ONLY PORTABLE GAMMA RAY DETECTOR EMPLOYING CRYSTAL SCINTILLATION. DETECTS ALMOST 100% OF GAMMA RAYS IN COMPARISON TO LESS THAN 1% DETECTED BY THE GEIGER COUNTER.



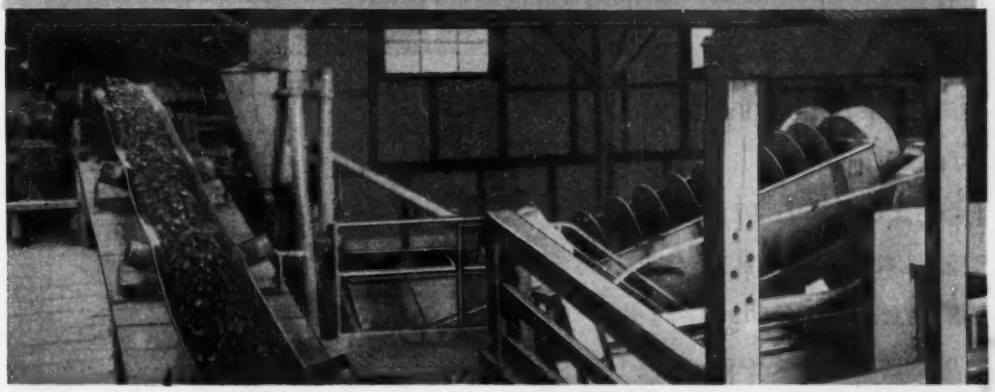
ALL TYPES GEIGER COUNTERS; SPECIAL LONG PROBE COUNTERS FOR TESTING DRILL HOLES; ULTRA VIOLET LIGHTS

Engineers Syndicate, Inc.

The House of Geiger Counters
5011 Hollywood Blvd.
Hollywood 27, California

AKINS 3-PRODUCT HMS SEPARATION ESTABLISHED PRACTICE FOR 4 YEARS

1st Demonstration - 1946 . . . 1st Commercial Installation - 1948



Proved Performance

FEED	PRODUCT	ASSAY	DISPOSITION OF MIDDLING	COMPANY	DATE OF INSTALLATION
R.O.M. Coal (Bituminous) 7" top size	Feed	10.28% ash	soluble product	Crystal Block Coal & Coke Co.	1951
	Float Coal	6.08% ash			
	Middling	25.44% ash			
	Refuse	70.57% ash			
Coal (Jig Middling) (Bituminous) 1½" top size	Feed	62.3% ash	diverted to refuse	U. S. Coal & Coke Co.	1949
	Float Coal	27.5% ash			
	Middling	40.7% ash			
	Refuse	78.0% ash			
Garnet 1" top size	Feed	no sample	recrushed & recycled to HMS	Barton Mines Co.	1948
	Tailing	2.8% garnet			
	Middling	32.9% garnet			
	Concentrate	91.5% garnet			
Zinc ore 1½" top size	Feed	2.00% zinc	recrushed for flotation feed	Eagle Picher Mining & Smelting Co.	1946 *
	Tailing	0.63% zinc			
	Middling	9.28% zinc			
	Concentrate	36.00% zinc			
Iron Ore (Mesabi) 1" top size	Feed	44.57% Fe	diverted to tailing	M. A. Hanna Co.	1951 *
	Tailing	12.39% Fe			
	Middling	36.52% Fe			
	Concentrate	57.76% Fe			
Iron Ore (Alabama Red Ore) 4" top size	Feed	57.76% Fe	stockpiled for future treatment	Sloss-Sheffield Steel & Iron Co.	1951
	Tailing				
	Middling				
	Concentrate	*operations just started, no data available*			*Pilot Plant

JUST *ONE* MEDIUM CIRCUIT . . . LOWER INITIAL COST, SIMPLIFIED OPERATION

These examples of actual HMS separations illustrate the flexibility of the Akins separatory vessel and the economies that are possible when middling particles are rejected from sink and float constituents of a crude feed.

The Akins requires just one medium circuit to make the middling separation. Result: lower initial plant cost; simplified operation, with only one point of gravity control.

Our engineers will welcome the opportunity of discussing Akins HMS as related to your particular problems . . . either in improving existing operations or designing a completely new HMS plant. Write or call, now.

The Akins is the only vessel now available with a background of proved performance. Write for Bulletin No. 49

COLORADO IRON WORKS CO.

DENVER 2, COLORADO

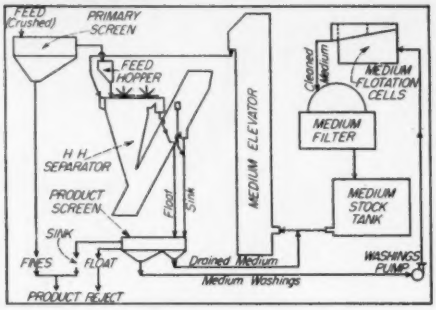
REPRESENTATIVES

Canadian Locomotive Co., Ltd., Kingston, Ont., Can., Licensed Manufacturer—Head, Wrightson & Co., Ltd., Stockton on Tees, Eng., Licensed Manufacturer—John Carruthers & Co., (Pty.) Ltd., Sydney, Aus., Licensed Manufacturer—Head, Wrightson & Co., S. A., (Pty.) Ltd., Johannesburg, Licensed Manufacturer—Edw. J. Holl Co., Manila, P. I., Sales Agents—Wright Bros., Credit Foncier Bldg., Vancouver, British Columbia, Sales Agents.

H H SINK FLOAT Process

for

- *increased metal recoveries*
- *reduced concentration costs*
- *savings in man hours*
- *increase in metal reserves*



THE WIDE UTILITY

H. H. SINK FLOAT PROCESS

PRE-ENGINEERED • PRE-FABRICATED

Recent developments in this widely-used ore separation process, have resulted in increases in metal recoveries, reduced concentration costs, savings in man-hours and increase in metal reserves.

Other advantages realized through the H. H. Sink Float Process include:

. . . ability to make closer separation on difficult feeds
. . . positive control of separation density
. . . positive removal of float product
. . . positive removal of sink product
. . . less power required for operation
. . . ability to treat coarser sizes
. . . easier to start after shut-down
. . . easy to run . . . any mill operator can run it
. . . low first cost per ton treated

Additional features of this process are:

. . . rejects coarse waste without grinding it
. . . produces coarse market concentrate
. . . permits non-selective mining
. . . treats metallics as well as non-metallics
. . . treats mine ores, dumps, fill, development ore
. . . serves existing and new installations

The H. H. Sink Float Plants are pre-engineered and pre-fabricated with economy in time and construction costs.

It will be to your advantage to explore the possibility of the H. H. Sink Float Process. Let us give you the names of plants now operating this process. Write for further information today.

SINK FLOAT

THE SINK AND FLOAT DIVISION
C. TENNANT, SONS & CO., OF NEW YORK
100 PARK AVENUE NEW YORK 17, N. Y.

in WIRE ROPE, too specialized use calls for the RIGHT KIND of muscle

Tough, wiry muscles stand the Rocky Mountain Bighorn in good stead; give him the sure-footed agility he must have to survive on almost impassable heights.

In wire rope, too, the right kind of muscle is mighty important... because different uses present different problems of wear and tear. Bending fatigue. Abrasion. Shock stress. Load strain. Each requires wire rope with the right construction and lay; the right grade of steel and size of wire to best withstand the destructive forces encountered.

Complete quality control from ore to finished rope; long experience and specialized know-how—these are your assurance that in Wickwire Rope you always get the proper combination of physical properties for long-lasting, reliable service on your particular job.

LOOK FOR
THE YELLOW TRIANGLE
ON THE REEL

THE COLORADO FUEL & IRON CORPORATION—Abilene (Tex.) • Denver • Houston • Odessa (Tex.) • Phoenix • Salt Lake City • Tulsa
THE CALIFORNIA WIRE CLOTH CORPORATION—Los Angeles • Oakland • Portland • San Francisco • Seattle • Spokane
WICKWIRE SPENCER STEEL DIVISION—Boston • Buffalo • Chattanooga • Chicago • Detroit • Emlenton (Pa.) • New York • Philadelphia

WICKWIRE ROPE

CF&I

PRODUCT OF WICKWIRE SPENCER STEEL DIVISION
THE COLORADO FUEL & IRON CORPORATION

Stephens-Adamson Belt Conveyor installation on the B & O Railroad Ore Dock, Baltimore, Md.

STEPHENS-ADAMSON MFG. CO.
Conveyor Manufacturer of Aurora, Ill., says:

"LUBRIPLATE Lubricants satisfy the "one-shot" requirements of our conveyor idlers. When introduced through the fitting on either side of the idler, LUBRIPLATE effectively lubricates each bearing in turn and flows through the hollow shaft to the next bearing. We do not know of a single case of bearing trouble through faulty lubrication where LUBRIPLATE has been used."

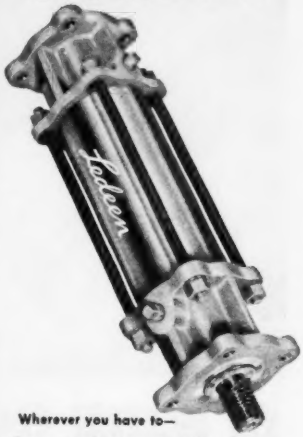
LUBRIPLATE Lubricants are available from the lightest fluids to the heaviest density greases. There is a LUBRIPLATE Product best for your every lubrication requirement. Let us send you case histories of savings that others in your industry are making through the use of LUBRIPLATE Lubricants. Also packed in handy tubes for portable tools, guns, fishing reels, lawn mowers and household uses.

LUBRIPLATE DIVISION
Fiske Brothers Refining Company
Newark 5, N. J. Toledo 5, Ohio

Dealers Everywhere...
Consult Your Classified Telephone Book

LUBRIPLATE *The Modern Lubricant*

INCREASE PRODUCTION
WITH *Ledeen* CYLINDERS



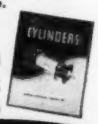
Wherever you have to—

PUSH or PULL
LIFT or LOWER
PRESS or SQUEEZE
TILT or TURN
OPEN or CLOSE

Ledeen cylinders provide positive, dependable power and pressure in straight line motion. Designed for air, oil, or water operation, they are uniform in design and construction, affording a wide number of varieties and adaptations. Ledeen cylinders are easy to install, occupy minimum space, and are built for long, economical service.

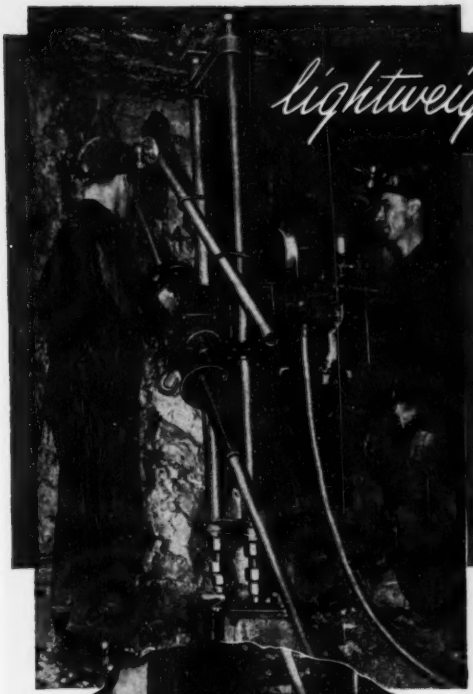
Standard Ledeen cylinders and mountings are available from distributors' stocks in major cities. Special cylinders if required. J.I.C., of course.

Ledeen Cylinders are GOOD Cylinders



Write for Bulletin 500

Ledeen Mfg. Co.
1606 San Pedro
Los Angeles 15, Cal.



lightweight and **POWERFUL**

...the Longyear

WOLVERINE

DIAMOND CORE DRILL

CUTS UNDERGROUND DRILLING COSTS

The Longyear WOLVERINE cuts underground drilling costs 3 WAYS

MOVING TIME IS REDUCED. This lightweight drill can be set up quickly. It can be knocked down for easier handling through narrow openings. The compact design of the WOLVERINE makes smaller drilling stations possible.

DRILLING TIME IS REDUCED because the powerful motor with 3 speed transmission provides either high speed for good drilling conditions or extra torque for long holes or tough going.

OPERATING COSTS ARE REDUCED. Balanced design reduces vibration and chatter . . . drill bits last longer. The best materials and workmanship in the WOLVERINE mean lower maintenance costs and longer drill life.

The Longyear WOLVERINE is available with air or electric motor; screw feed or hydraulic head. It is furnished with drum hoist. Bit speeds up to 2500 R.P.M. Weight: (with air motor and screw feed) only 500 lbs. Capacity: 800 ft. of 1½ inch hole.

● INVESTIGATE THE 3 WAYS a Longyear WOLVERINE Diamond Core Drill will cut your underground drilling costs.

Write TODAY for revised Bulletin No. 71.

Other Longyear underground Diamond Core Drills are available with capacities from 300 ft. to 2000 ft. of 1½ inch hole.

E. J. LONGYEAR COMPANY

MINNEAPOLIS, MINNESOTA, U. S. A. NEW YORK OFFICE, 1775 BROADWAY

CANADIAN LONGYEAR, LIMITED, NORTH BAY, ONTARIO, CANADA

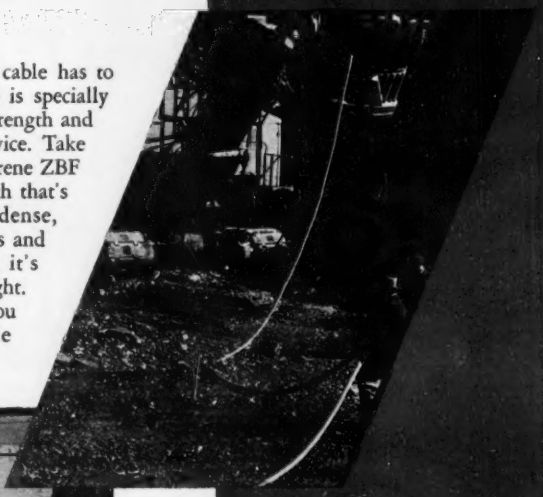
DIAMOND CORE DRILLS • CONTRACT CORE DRILLING
SHAFT SINKING • GEOLOGICAL INVESTIGATIONS

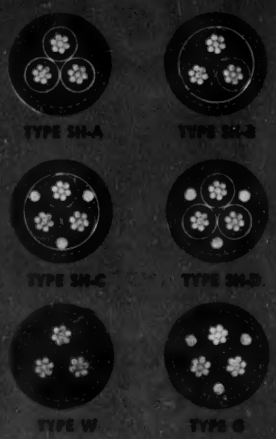
REPRESENTATIVES IN PRINCIPAL MINING CENTERS IN THE UNITED STATES AND OTHER COUNTRIES.

back up your shovels with

TOUGH, MOLD-CURED HAZACORD

IT'S A TOUGH LIFE that electric shovel cable has to face. That's why Hazacord Shovel Cable is specially designed and constructed with the extra strength and durability that pays off in this severe service. Take Hazacord's outside protection—the Hazaprene ZBF Sheath. It's a double-layer, reinforced sheath that's mold cured under pressure to form a dense, homogeneous wall with tire-tread toughness and resiliency. Compounded with neoprene, it's unaffected by oil, acids, water, and sunlight. Yet with all the life-extending toughness you get with Hazacord Shovel Cable, ample flexibility for easy handling is retained.

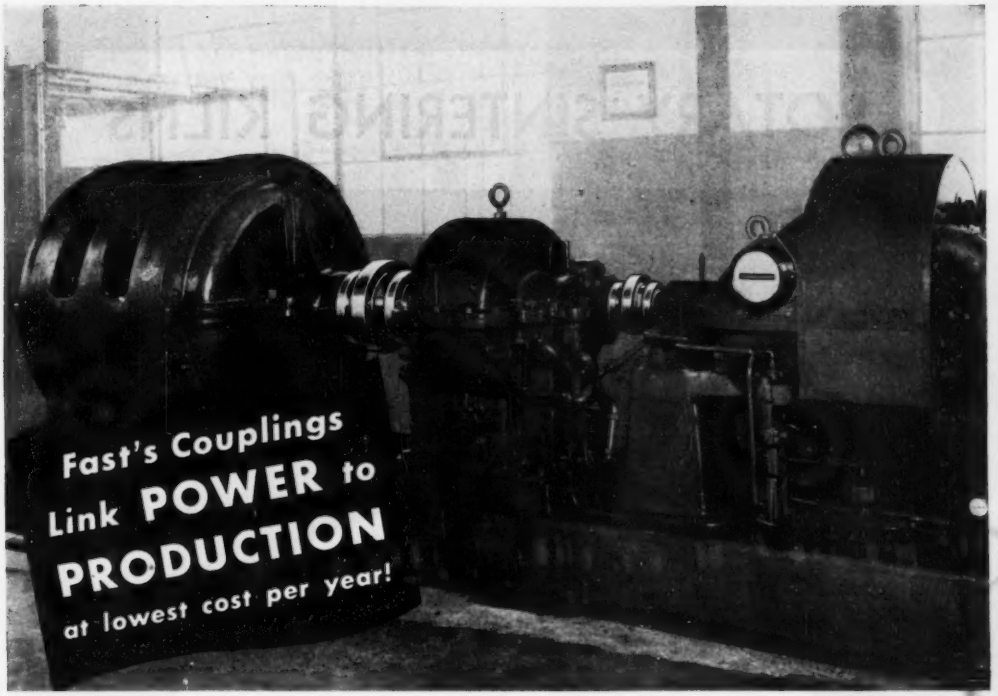




TO KEEP SHOVELS WORKING Hazacord is designed-for-the-job with many "inside" features as well that give you *extra protection* against cable failure. Long-lived, electrically stable, heat-resisting Performite insulates each conductor; permanently colored Okobestoprene Tape (a non-fibrous asbestos-neoprene material developed by Okonite) is precision wrapped around each insulated conductor. It seals into a flame- and moisture-resistant, non-rotting protective covering that also provides flexibility and permanent circuit identification. For moisture tightness at cable ends, and added cushioning qualities, Hazaprene fillers are used in conductor interstices instead of ordinary fibrous material.

For full information on Hazacord's many features that are delivering money-saving service in more and more operations—ask your Hazard representative to call, or write Hazard Insulated Wire Works, Division of The Okonite Company, Wilkes-Barre, Pa.

HAZARD ...bles for every mining use



Every major producer of high-speed equipment uses FAST'S Couplings!

HIGH-SPEED equipment demands components with superior strength, accurate manufacture, long-lasting dependability. That's why it's important to *you* that Fast's Couplings are selected by every major high-speed equipment producer!

Fast's usually outlast the equipment they connect. Many have been in continuous operation for over 30 years, without trouble of any kind. And Fast's longer life saves you coupling dollars, too, because you amortize their cost over many years of trouble-free operation.

For full details on Fast's Couplings and Koppers Engineering Service, write today for your free copy of our catalog. Send to: KOPPERS COMPANY, INC., *Fast's Coupling Dept.*, 292 Scott St., Baltimore 3, Maryland.

Here's How FAST'S Save You Money

Free Service—Koppers free engineering service assures you the right coupling for the job.

Rugged Construction—Fast's still maintains its original design, without basic change or sacrifice in size or materials. Result: freedom from expensive coupling failures.

Lowest Cost per Year—Fast's Couplings usually outlast equipment they connect. Their cost may be spread over many years!

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FAST'S
THE ORIGINAL
GEAR-TYPE
Couplings

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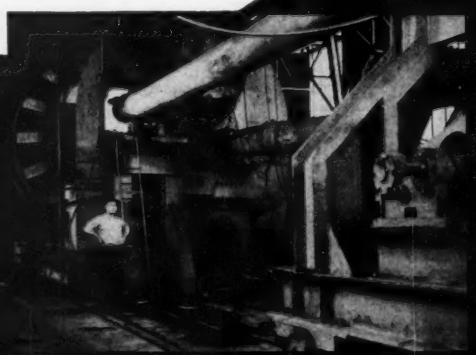
Iron ore, manganese ore, phosphates of all sizes, flotation concentrates and flue dust alone or mixed, can be sintered regardless of moisture and carbon content.

Sintering temperature easily regulated and maintained as desired, producing sinter of proper porosity and hardness, thus saving blast furnace fuel.

Materials sintered without fines, eliminating screening and rejects.

Any available gas, oil or pulverized solid fuel may be used.

Low power consumption—7 to 8 kwh per ton of sinter.



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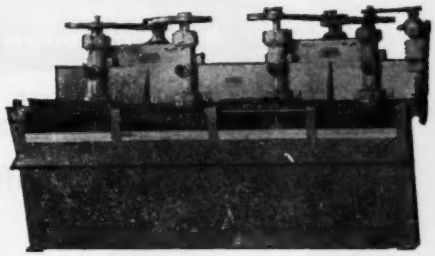

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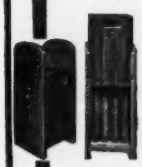


EXPLOSIVE BOXES

Approved by the Pa. Dep't. of Mines, these rigid non-conductive explosive boxes represent a prime safety investment. Made entirely of wood—tongue-grooved and dovetailed construction . . . no metal parts. . .automatic lock. . .rubber band spring . . . moisture-resistant. Box sizes are based on 1¼" x 8" sticks.

POWDER BOX PRICES ARE AS FOLLOWS:

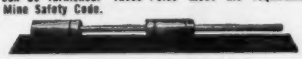
No. 9	$2.55 ea.	No. 25	$5.10 ea.
No. 12	2.95 ea.	No. 36	6.50 ea.
No. 16	3.45 ea.	No. 50	7.60 ea.
No. 20	3.90 ea.	No. 72	8.70 ea.

DETONATOR BOX PRICES ARE AS FOLLOWS:

No. 6, size 2½" x 3" x 6" inside...$2.15 ea.
No. 8, size 2" x 2½" x 8" inside... 2.15 ea.

WOOD TAMPING POLES

For Tamping Explosive Shots: Poles are round, made of Hardwood. Sizes to 10' long. Price per lineal ft.: 1" dia. 8c; 1¼" dia. 12c; 1¼" dia. 14c; 1⅜" dia. 16c; 1½" dia. 18c; 1¾" dia. 28c; 2" dia. 32c. Special diameters and lengths can be furnished. These Poles meet the requirements of the New Federal Mine Safety Code.



SECTIONAL TAMPING POLES

These poles are made of straight grained wood and are coupled together with removable wood pins held in place in recessed grooves by a rubber band and can be quickly connected and unconnected.
Couplers and Head Blocks are 4, 5 and 6 inches in diameter. Please specify size when ordering. Poles are 1½" in diameter.
Head Blocks, $3.70 ea.; Couplers, $3.90 ea.; Poles 12 feet long, $3.00 ea.; Poles 14 feet long, $4.20 ea.; Poles 16 feet long, $4.80 ea.; Poles 18 feet long, $5.30 ea.; Poles 20 feet long, $7.00 ea.; Poles 22 feet long, $8.00 ea.; Poles 24 feet long, $9.60 ea.

J. V. HAMMOND CO., Spangler, Pa.

We also manufacture Shot Firing Units, Wooden Mallet and Wedge Sets, Trolley Poles, Sounding Sticks, Mine Rollers, Insulation Blocks and Brake Blocks

SENSATIONAL SAVINGS NOW MADE POSSIBLE!

Actual performance records in plant after plant prove that Magic-Vulc doubles and triples conveyor belt life and saves thousands of dollars in belt replacement costs.

REPAIRS WORN BELTS—EASY TO APPLY

Magic-Vulc is a self-cold-curing plastic rubber compound that gives old, worn out conveyor belts a new lease on life! When applied to badly worn spots on a conveyor, it forms a tough flexible coating that resurfaces the belt and makes it ready for efficient operation again.

Magic-Vulc requires no heat or special machinery. Your own workmen can apply it without removing belt from pulley. After only 12 hours of standing (cold-curing), the belt is ready for use. 20 lb. can of Magic-Vulc coats an area of 75 to 100 sq. ft., depending on condition of belt.

Magic-Vulc also has countless other applications as a tough coating to protect all types of industrial equipment from corrosion and abrasion.

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Try Magic-Vulc in your own plant at our risk! We'll send you a complete trial kit, including all the chemicals and tools you need, for only $37.50. You must be 100% satisfied or your money will be quickly refunded.

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There are almost 1500 types and sizes in Laughlin's quality line of drop forged fittings.

There are many different styles of shackles, swivels, hooks, thimbles, clips, sockets, eye bolts and other products designed for a wide variety of applications throughout industry. If you use wire rope or chain, you can be sure that Laughlin has the right — *and safest* — fittings for the job.

THESE EXCLUSIVE PRODUCTS

Safety "FIST GRIP" Wire Rope Clips . . . Fool proof, easy to install Fist Grip clips hold rope more securely, can't go on wrong. Fewer clips are required than for ordinary types, and they will not crush or distort the rope.

SAFETY HOOKS . . . The latch locks the load, will not open until released by operator. Strong, drop forged steel hook has improved latch that leaves 80% of throat opening. 15 sizes; 3 patterns, eye, shank and swivel.

"MISSING LINK" (Reg. U.S. Pat. Off.) . . . Cheaper than welding, safer than cold shut or cast link, "Missing Links" go on in a jiffy and are stronger than proof coil chain. 17 sizes from 3/16" to 1⅞".

CLEVIS GRAB AND SLIP HOOKS . . . These sturdy hooks are easily attached to any welded link chain. Pin and cotter make it easy to attach or remove for use on another job. Needs no connecting fittings or special tools.

Laughlin's new Catalog No. 150 lists the complete line of drop forged wire rope and chain fittings with illustrations, description and specifications. Write for it today.

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Adjustable leather nose bridge for extra comfort. Ample room for prescription glasses.

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"Canton Car Transfer"

No need to dig and take out twice the width of a tunnel when a single track will do the job more economically . . . loads entire train on the single track. This famous economy device can be installed on any track of gauge and rail now in use. Its operation is simplicity itself . . . pushing empty car on track by locomotive, then moved by hand to transfer section, permitting locomotive and cars to pass. Train is pulled out all at one time. Two men in two minutes can take down, to move the three units to new location when desired . . . no alterations required for track or rails.

Timken Roller Bearings enable easy shunting of heavy cars to maximum weight of six tons. The Car Transfer speeds up loading, hauling, saves expensive double-tracking. Write for complete literature; please use street and zone numbers.

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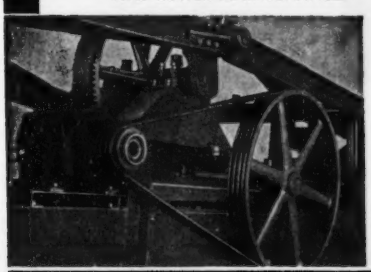

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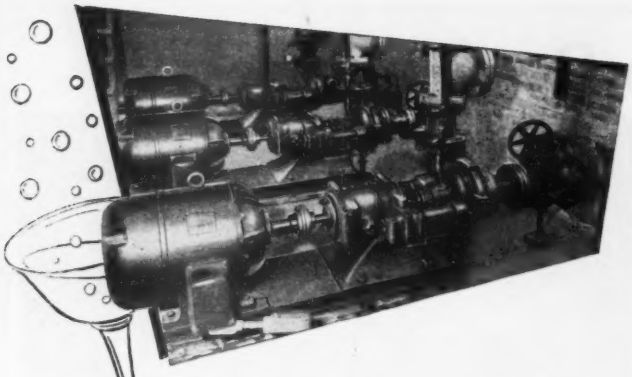

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Making "grade A" copper depends on the constant circulation of hot, corrosive copper sulphate. This battery of Nagle type TW pumps guzzles hundreds of gallons of this metal ravaging mixture a day in a smelting and refining plant. Famous Nagle features like these will keep on the job years longer: select corrosion-abrasion alloys for water end parts, ample slippage seal adjustment, maintenance that is a marvel of simplicity. Follow the lead of hundreds of Nagle pump users. Write today for the complete Nagle solution to your most corrosive or abrasive pumping problems . . . vertical, horizontal and self priming.

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The Teredo drill head adjusts instantly for drilling within a 360° radius. This combined with other Acker features such as built-in pumps, cargo-type winches, hydraulic or screw feed heads, choice of power plant, mounting on drag or any type of vehicle, are bound to save time, labor and on-the-job costs.

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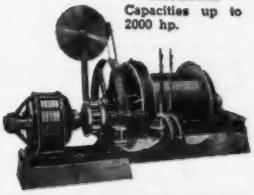

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LONGER LIFE with KUE-KEN* GYRACONES

Kue-Ken Gyracone Crushes 90,000 Tons of Hard River Gravel on One Set of Liners

Previous well-known gyratory on same job crushed only 30,000 tons per set of liners. A 66% reduction in cost of crushing faces per ton.
Further saving is made by increased production because of less frequent shut-downs for relining.
MINE OPERATORS: Kue-Ken Crushers will give Lower crushing costs with higher capacity.

Less Wear with Modern Design

Crushing without rubbing gives Kue-Ken operators longer life to crushing faces. Rock is instantly gripped and crushed between the crushing faces without slipping and rubbing. Rock is not forced upwards grinding away the costly crushing faces as in ordinary gyratory crushers. Wear and power are reduced to the minimum, capacity is maximum.

* Pronounced Que-Ken. U. S. and Foreign Patents Pending.

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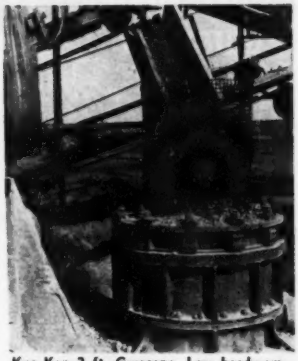

Kue-Ken 3 ft. Gyracone. Low headroom. Full choke feed.

STRAUB MFG. CO. — 516 CHESTNUT ST. • OAKLAND 20, CALIFORNIA

Kue-Ken Jaw Crushers	Revolving Screens	Rib Cone Ball Mills
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Pennsylvania Crusher Co., Exclusive Licensed Eastern Manufacturer and Distributor Broad and Arch Streets, Philadelphia, Pennsylvania.
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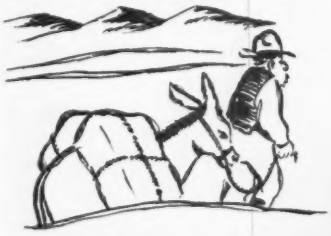

IN THEM THAR HILLS!
FRESH AIR BOOSTS OUTPUT

Shipped in fiber drums for safekeeping, easy handling.

ABC Mine Vent Tubing delivers air where men NEED it, in mine or tunnel.
LIGHT—TOUGH—Rates high in abrasion, scrub, flex-fold tests.
MILDEW PROOF—Tested by soil burial.
AIR TIGHT—Acid water resistant.
QUICK, EASY installing, demounting. Handy handling in cramped space. Exclusive snap-on patent coupling quickly joins sections—provides leakproof seal.
NON-TWIST—Rotate to right position or to relieve points of wear.

AMERICAN BRATTICE CLOTH CORP.

220 S. BUFFALO STREET — WARSAW, INDIANA

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Advertising men agree—to do a complete advertising job you need the double effect of both Display Advertising and Direct Mail.

Display Advertising keeps your name before the public and builds prestige.

Direct Mail supplements your Display Advertising. It pin-points your message right to the executive you want to reach —the person who buys or influences the purchases.

In view of present day difficulties in maintaining your own mailing lists, our efficient personalized service is particularly important in securing the comprehensive market coverage you need and want.

Ask for more detailed information today. You'll be surprised at the low overall cost and the tested effectiveness of these hand-picked selections.

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PUTTING IT ON THE LINE...

in Industry after Industry!

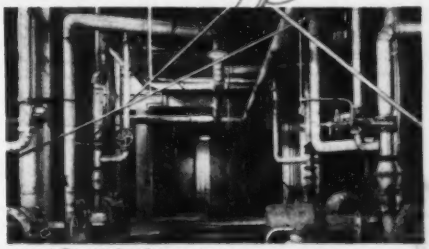
The Grinnell-Saunders Diaphragm Valve . . . . . .

Here's why . . . Piping in today's complex industrial plants is an exacting science involving the handling of highly corrosive fluids, gases, compressed air, beverages, foods and suspended solids . . . in lines where corrosion, abrasion, contamination, clogging, leakage and maintenance are costly factors. Under such conditions, the amazing adaptability of the Grinnell-Saunders Diaphragm Valve explains its acceptance by industry after industry.

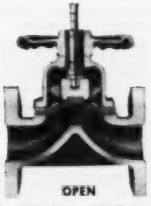
Bodies of this versatile valve are made in a variety of metals — iron, stainless steel, bronze, aluminum and others. *But of more importance* is the fact that a body of cast iron (a metal not in short supply) can be lined with glass, lead, natural rubber, neoprene and other materials which, in many instances, handle corrosive fluids *better* than metals.

Diaphragms come in natural rubber, neoprene, butyl, hycar, a special synthetic for foods, and KEL-F. This last is chemically inert to all acids and alkalies in all concentrations with the exception of molten alkali metals.

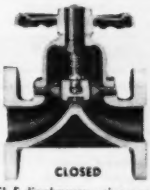
From this broad selection of materials, the problems which the Grinnell-Saunders valve can solve are extremely varied. No wonder industry after industry is putting it on the line.



PULP AND PAPER MILL. Rubber-lined Grinnell-Saunders Valves on stainless steel piping handle sulphate pulp stock in bleach plant of Potlatch Forests, Inc., Lewiston, Idaho.



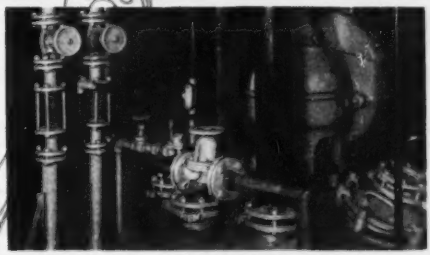
OPEN



CLOSED

Showing rising spindle . . . valves are available with rising or stationary spindle.

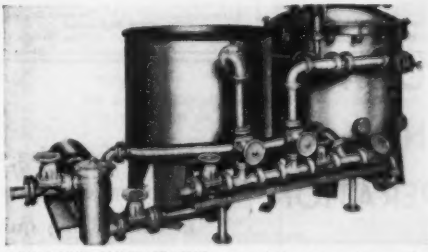
KEL-F diaphragm, using special rubber backing cushion and floating tube nut design.



CHEMICAL PLANTS. Glass-lined Grinnell-Saunders Diaphragm Valves, with KEL-F diaphragms, handle chlorinated organic chemicals at Hooker Electrochemical Company, Niagara Falls, N. Y.

CHECK THESE GRINNELL-SAUNDERS FEATURES...

- Diaphragm absolutely isolates working parts from the fluid.
- Diaphragm lifts high for streamline flow in either direction.
- Diaphragm presses tight for positive closure.
- Body, lining and diaphragm materials to suit service.
- Simple maintenance — diaphragm easily replaced.



EQUIPMENT MANUFACTURERS. Grinnell-Saunders valves with rubber linings are standard on filtration equipment for solution clarification, made by Industrial Filter & Pump Mfg. Co., Chicago, Ill.

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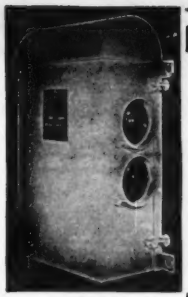

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Thrown by Motorman

Operates Switch Safely • Saves Time and Money

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Exploration for coal and other mineral deposits. Foundation test boring and grout hole drilling for bridges, dams and all heavy structures.

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- They have *out-performed* the – –and– –bits.
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- . . . the Best bits used thus far on our drilling at – –
- Cut the *highest footage* obtained by any bit on this job!
- Our records indicate a pretty good margin in favor of your bits.
- The first Ascolite bit you sent me worked fine . . . please send me six more . . .
- . . . greatly pleased . . . find them more serviceable than other pre-set bits tried.
- . . . drilled over 500 feet in ground where the average for hand-set bits is 110 feet . . .
- The bits were . . . unusually satisfactory and it is desired to obtain four new bits like them.
- . . . shows a considerable saving . . . over our own cast-set bit . . . we wish to have four more made up.
- *The letters containing the above comments are on file in our New York Office.*

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Importers and Dealers • Carbons, Bortz, Ballas
Manufacturers of Diamond Tools
333 W. 52nd St., New York 19, N. Y. Cables: PROFITABLE, New York

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(Classified Advertising)

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MILL SUPERINTENDENT. Man familiar with crushing, conveying and elevating machinery. Location mid Virginia. If interested give full details regarding self. Age desired 30 to 45 years. FP-2725, Engineering & M Jl.

WANTED—MINING Engineer. Graduate engineer familiar with geology and metallurgy. Must have experience in strip mining, washing a very heavy clay, and in Heavy Media and Dutch Cyclone operation. Should also be able to handle and understand people. P-3137, Engr. & Mining Jrl.

SELLING OPPORTUNITY OFFERED

SALESMAN—NATIONALLY known manufacturer seeking experienced salesmen for its mining department. Must have knowledge of coal mining methods and equipment. West Virginia, Pennsylvania, Ohio, and Eastern Kentucky. Mining acquaintance desirable. Applicants must give age, education, experience and salary required. SW-2982, Engr. & Mining Jrl.

POSITIONS WANTED

EXECUTIVE ENGINEER. Mining Engineer Graduate. 25 years management experience from plant operation to Vice President in charge of manufacturing for national concern. Management and operational experience in gypsum, asbestos, cement, paper, felt, asphalt products. West Coast or South location preferred. Prefer permanent position but would consider connection on consulting basis. PW-2983, Engr. & Mining Jrl.

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1,000 Acres Proven Manganese Lands in Batesville-Cushman Quadrangle, producing now. Will sell, write Bee Vanemburg, owner, Batesville, Arkansas.

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PW3153 Engineering & Mining Journal
330 W. 42 St., New York 36, N. Y.

FOR SALE OR LEASE BY OWNER
Lead and zinc mine with mill and mine equipment on ground. Guaranteed title. Also for sale, 110 acres of manganese property. Details furnished to responsible parties.
BO3188 Engineering & Mining Journal
330 W. 42nd St., New York 36, N.Y.

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For Mine Slope
Capable of minimum
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Give full details.

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SURFACE MINING CONTRACTS WANTED
Contractor desires contracts, no share or percentage proposals, for open pit mining and surface development including access roads in Western United States. Have modern machinery and experienced personnel.
J. HENRY HARRIS
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OPEN PIT MINING
Contractor with excellent equipment and experienced personnel interested in excavating, material handling, or open pit mining work.
CW1319 — Engineering & Mining Journal
330 W. 42nd St., New York 18, N. Y.

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a magazine for collectors.
If you collect rocks, minerals, sands, pebbles, crystals, ores, gems, ROCKS AND MINERALS is your magazine. Founded in 1920, issued once every two months. 112 pages per issue, $3.00 a year (sample copy 60¢).
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Huge virgin deposit near R.R. Flat quarring—bench blasting. Many, many million tons uniform. Clear title. Sale or lease.
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FOR SALE
ONE STEEL BUILDING
with aluminum roof and siding.
382 feet long, 36 feet wide and 15 feet 9 inches high. These are inside dimensions.
F. S. 2726 Engineering & Mining Journal
330 W. 42 Street New York, N. Y.

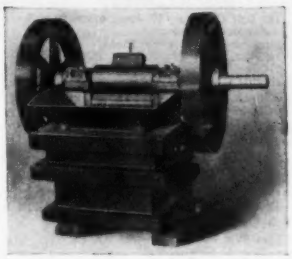
DEPENDABLE EQUIPMENT AT A SAVINGS IN TIME AND COST

COMPRESSORS

1—6" x 5" Worthington horizontal, 80 CFM.
1—6" x 6" Gardner vertical, 90 CFM.
1—8¼" & 4¼" x 5" Chicago-Pneumatic, 131 CFM.
1—7" & 5¾" x 5" Gardner-Denver, 156 CFM.
1—12" x 10" Ingersoll-Rand, 179 CFM.
1—14" & 9" x 8" Blaisdell, 213 CFM.
1—12" & 6½" x 10" Ingersoll-Rand, 293 CFM.
1—14" & 7½" x 12" Ingersoll-Rand, 447 CFM.
1—14" & 8¾" x 10" Sullivan, 637 CFM.
1—16" x 12" Union, 698 CFM.
1—18" & 11" x 16" Ingersoll-Rand, 800 CFM.
1—13" x 10" Laidlaw, 840 CFM.
1—24" & 13" x 16" Ingersoll-Rand, 1418 CFM.
1—210 CFM Worthington "Blue Brute" portable compressor driven by Continental gas engine.
2—310 CFM Gardner-Denver portable compressors driven by Buda gas engines.
2—5½" & 5½" x 4½" Sullivan 144 CFM compressors driven by 25 HP motors, mounted on 36" ga. trucks.

LOCOMOTIVES

1—2½ ton Mancha battery locomotive "Titan A" 24" ga. with 2 sets Edison batteries and charging set.
1—2-2½ ton Whitcomb battery, 24" gauge
2—7 ton G.E. permissible type battery, 36 gauge
2— 8 ton G.E. battery, 36" gauge
4—10 ton Atlas battery, 36" gauge
1— 3 ton Whitcomb gas engine driven, 24" gauge
1— 3 ton Ruth gas engine driven, 18" gauge
1— 6 ton Goodman trolley, 36" gauge
2—8 ton Goodman battery, 36" ga.
2—5 ton Mancha battery, 36" ga.
1—5 ton Jeffrey battery, 36" ga.
2—8 ton Goodman trolley, 36" ga.
1—5 ton Goodman trolley, 36" ga.



JAW CRUSHERS

2—8" x 12" Universal 2M
1—9" x 12" Cedar Rapids
1—8" x 24" Rogers
1—8" x 36" Universal
1—9" x 36" Cedar Rapids
1—13" x 24" Telsmith
1—15" x 28" Pacific
1—8" x 8" Universal
1—9" x 15" Farrell

MISCELLANEOUS EQUIPMENT

1—Ingersoll-Rand wagon mounting drill type FM2 mounted on 2 rubber tired wheels.
1—27" x 14" MacFarlane crushing rolls.
1—54" x 26' rotary dryer.
1—150 HP Vulcan single drum-hoist complete with motor and controls.

SAND PUMPS

1—1" Wilfley sand pump
2—2" Wilfley sand pumps.
1—2" Denver vertical sand pump
3—2" Telluride sand pumps
1—2½" Traylor sand pump
1—3" Allen-Sherman-Hoff rubber lined hydro-seal
1—3" Wilfley sand pump
1—3" Telluride sand pump
1—4" Allen-Sherman-Hoff hydro-seal
1—4" Denver vertical sand pump
1—6" Wilfley sand pump

TUGGER HOISTS

1—Dillon-Box model 3 single drum air tugger.
1—Ingersoll-Rand model 6 HC single drum air tugger.
1—Ingersoll-Rand size 5NN-01-1 2 drum electric slusher hoist.
1—Sullivan class RH single drum electric tugger.
1—Ingersoll-Rand size 107 single drum electric tugger.
1—Sullivan model D211 2 drum electric slusher hoist.
2—Sullivan type HE D.C. single drum electric tuggers.
9—Sullivan type HDE D.C. double drum electric slusher hoists.
1—Sullivan model HDE 10B 2 drum tugger hoist direct driven by 4 cyl. Continental gas engine.

GRINDERS & SHARPENERS

1—Ingersoll-Rand new jackbit grinder size JA4 air driven.
1—Massco type G rockbit grinder with 5 HP motor.
1—Ingersoll-Rand bit grinder J3 with 3 HP motor.
1—Ingersoll-Rand bit grinder model J03 driven by Wisconsin gas engine.
1—Ingersoll-Rand #50 drill sharpener.
1—Ingersoll-Rand #40 drill sharpener.
1—Ingersoll-Rand #5 drill sharpener.

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ESTABLISHED 1898

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NEW AND REBUILT
SINCE 1902
STATIONARY OR PORTABLE
FOR REBUILDING AT ITS FINEST
TRY AMERICAN
RENT—SELL—BUY

YOUR CHOICE
American — Bury — Chicago Pneumatic — Curtis — Davey — Gardner Denver — Ingersoll Rand — LaMont — Pennsylvania — Schramm — Sullivan — Worthington

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273 AIR COMPRESSORS AVAILABLE
RENTAL PURCHASE
GAS — DIESEL — ELECTRIC

AMERICAN AIR COMPRESSOR CORP.
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8 Electric 5,000, 3,865, 3,178, 2,200, 1,578 & 1,302 1,000 678 & 500 Ft.
8 Diesel 1,578, 1,000, 678 & 500 Ft.
LOCOMOTIVES AND CRANES
12 Diesel 100, 80, 65, 45, 30, 20 Ton Locomotives.
22 Gas, 35, 25, 16, 12, 8 & 6 Ton Locomotives.
40 Ton Orton Diesel Locomotive Crane.
R. R. CARS
100 Dump Cars, 2, 4, 12, 20 and 30 Yd.
100—60 Ton Flat Cars, 66—50-Ton Gondolas.
150—8,000 & 10,000 Gal. Cap. Tank Cars.
TUNNEL MUCKERS — LOADERS
4 Gardner Denver GD9 & GD14.
10 Elmco 12B & 21. 4 Sullivan HL20.
LARGE JAW CRUSHERS
7—60"x84", 48"x48", 36"x42", 24"x36" & 22"x36".
ROTARY DRYERS AND KILNS
48"x20', 48"x45', 54"x40', 60"x50', 70"x45', 80"x60', 84"x50'.
Single and Double Shell.
Kilns, 8'x80', 4'x45' & 8'x170'.
BALL, ROD & TUBE MILLS & CLASSIFIERS
3—5'x22' A.C. Tube Mills
5'x22', 6'x22', 6'x48", 8'x22" & 8'x36" Hardinge Conical Ball Mills.
4x4, 6x8 & 7x5 Cylindrical Ball Mills.
5', 10' & 16' Mechanical Air Separators.
36', & 70' Spiral and 4' Dorr Rake Classifier.
4x10, 5x12, 7x16 Red Mills, Marcy, Hardinge.
Cottrell Precipitator 106,000 CFM.
Dings 3-stage 18" Wetherill Mag. Separator.
200 400 & 700 HP—Double Drum Mine Hoists.
75, 300, 450, 500 & 700 HP Single Drums.
STEEL STORAGE TANKS
40—10,000 Gal. R. R. Car Tanks.
PULVERIZERS
Hercules Jr. & #1 & 2 Ring Roll.
STANHOPE, 60 E. 42nd St., New York 17, N. Y.

CRUSHING ROLLS, 12 x 12 AC (new), 16 x 10, Sturt. 30 x 16 Farrel, 48 x 18 Traylor.
HARDINGE MILLS, 5' x 22", 7' x 48", 8' x 22" all with motor drives.
JAW CRUSHERS, 6" x 9", 8" x 10", 14" x 24", 36" x 42".
DUMP CARS, 200 Side dump, 1¼ yard, 24" gauge.
EUCLID DUMP TRUCKS, 15 ton, 22 ton, & 33 ton cap.
NEW CENTRIFUGAL MOTOR PUMPS to 750 GPM.
MARLOW Portable Centrifugal, 25 HP gas. 500 GPM.
AIR COMPRESSORS — EXHAUSTERS — CONVEYORS

LAWLER COMPANY
Durham Ave. Metuchen, N. J.
Metuchen 6-0245 N. J.

Rotary Kilns—6½ x 80'—8½ x 9½ x 200'.
Rotary Dryers—3' x 30'—4' x 30'—6' x 40'—8½' x 50'—6½' x 60'—8½' x 70' & 7½' x 70'.
Tube & Ball Mills—6' x 9'—5' x 22'—8½' x 18'.
Fuller-Lehigh Mills—22'—47' & 52'—Bradley Mills.
Jaw Crushers—From 10" x 6" up to 38" x 24".
Crushing Rolls—From 14" x 24" up to 72" x 36".
1—Complete Lime Hydrating Plant.
Sturtevant Rotary fine crushers—No. 0—No. 1—No. 1½ and No. 2.
Ring Roll Mills—Sturtevant No. 1—No. 2 duplex.
15'—18' & 18' Herreshoff furnaces.
Gyratory Crushers, No. 3 and No. 12.
5' & 9' Gayto — Air separators.
Magnetic separators—Jigs—screens—classifiers and thickeners.
3', 6' & 7' dia. Red Mills. Mine Hoists.
8' x 10'—8' x 12'—11½' x 19' Rotary Filters.
1—6' Raymond "Whizzer" Separator.
New Dryers and Kilns.

W. P. HEINEKEN, INC.
50 Broad Street, New York

CRUSHERS, JAW: Sizes 12" x 18" to 48" x 60".

CRUSHERS, REDUCTION TYPE: Symons 2 ft. Cone, coarse bowl; Telsmith 13-B, Gyratory, 12" opening, all steel, 50 H.P. motor.

CRUSHER, ROLL: 40" dia., 24" face, manganese fitted, 75 H.P., 220/440 volt motor.

DRYER or KILN: 1—10 ft. x 90 ft. heavy duty with or without auxiliary equipment, condition like NEW.

AIR SEPARATOR: Sturtevant 8 ft., extra heavy liners, new 1944, with steel supports, used six months.

CLASSIFIERS: 4—Akins 54" Simplex single pitch. Weir type, 220/440 volt motors, used four months.

PULVERIZER: Hardinge 10 ft. dia. x 36" Conical Ball Mill, manganese lined, 350 H.P., 2260 volt motor, with all auxiliary equipment for dry grinding. Used 90 days.

COMPRESSORS: Worthington DC2, 20/18-½ x 21, motor 600 H.P. synchronous, 440 volt, with all auxiliary equipment. 4—Ingersoll Rand Diesel Portable 500 cu. ft. @ 100 lbs. pressure. New 1951.

BLOWER: Connersville 9000 CFM, 1-½ lbs., 19" x 54", type RCB, 75 H.P., 2200 volt, roller bearing motor and control. New 1951.

LOCOMOTIVE, ELECTRIC: 10 ton Goodman, trolley type, 250 volt, D.C., 36" gauge.

MINE HOISTS: 150 H.P., 6'6" dia., 6'8" face. 200 H.P., 72" dia., 48" face. 250 H.P., 60" dia., 72" face. 300 H.P., double drums, 5' dia., 4' face, one stubbed. All 3 phase, 60 cycle, 2200 volt with control equipment. Head Frame for double shaft 16'9" x 17'2", height 55 ft., with or without 8 ft. dia. sheaves for 1-1/2" rope. Other Hoists 100 H.P. to 1050 H.P., single and double drum, with electric equipment.

ELECTRIC MOTORS: 2—NEW 1000 H.P., 1200 RPM, 2300 volt, drip proof, with automatic switch gear. (Unused). 1—950 H.P. HOIST Motor, slip ring, 3 phase, 60 cycle, 2200 volt, 443 RPM, with all control equipment.

SHOVEL, ELECTRIC: Bucyrus Erie 4 yd. capacity, 2200 volt.

CRANE: Northwest model 95, diesel, 80 ft. boom, 2-½ yd. capacity, used nine months.

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Phila. Phones: MAdison 3-8300 — 3-8301

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1—7½ HP Hoist with Motor

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Bucyrus-Erie 54-B Standard Shovel with 26 ft. boom, 18 ft. dipper handle, 2½ cu. yd. bucket. Powered by Buda Diesel. This machine has been completely overhauled, and is ready to go. Location, Woodbridge, N. J.

Lima Type 1201 Loading Shovel, 28 ft. boom, 24 ft. dipper stick, 3½ cu. yd. dipper. Powered by Cummins Diesel. Location, Mountain Iron, Minnesota.

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14"	4	1/16"	1/32"	28 Oz.
16"	4	1/8"	1/32"	28 Oz.
18"	4	1/8"	1/32"	28 Oz.
20"	4	1/8"	1/32"	28 Oz.
20"	5	1/8"	1/32"	28 Oz.
24"	4	1/8"	1/32"	28 Oz.
24"	5	1/8"	1/32"	28 Oz.
26"	5	1/8"	1/32"	28 Oz.
30"	4	1/8"	1/16"	32 Oz.
30"	5	1/8"	1/16"	32 Oz.
30"	6	1/8"	1/16"	32 Oz.
36"	6	1/8"	1/16"	32 Oz.
42"	5	1/8"	1/16"	32 Oz.
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Qu	HP	Make	Type	Volts	RPM
1	400	Cont.	NZ-808	2300	1200
1	400	G.E.	IK	2200	514
1	400	G.E.	KT-413	2200	435
2	300	Whse.	CS-890	2300	1780
1	200	Whse.	CS-873C	2200	3160
1	200	Al.Ch.	AR	440/220	580
2	125	Al.Ch.	AR	2200	1750
1	125	Whse.	CS-761C	440/220	1750
1	125	C.W.	126-G	440/220	430
2	100	Whse.	CS-663C	440/220	1750
1	100	Al.Ch.	AR	550	690
1	100	F.M.	H241B	440/220	435
1	100	Whse.	CS-938	2200	495
1	78	G.E.	I-K15	440/220	570
1	75	Al.Ch.	AR	2200	1765
1	75	Al.Ch.	AR	2200	1750
1	75	Al.Ch.	AR	2200	690

SYNCHRONOUS MOTORS
3-Ph., 60-Cy.

Qu	HP	Make	PF	Volts	RPM
1	3000	Whse.	80	4700/2400	720
1	750	G.E.	80	2300	450
1	187	G.E.	80	220/440	720
1	150	G.E.	100	2200	900
1	150	G.E.	100	550/2200	600
1	150	G.E.	80	550/2200	450
3	125	G.E.	80	4000/2200	1200
3	125	El.Mchy.	100	4800/2400	900
1	125	G.E.	80	2200	900
2	100	Whse.	80	440/220	1800
1	100	Whse.	100	2200	1200
1	100	Ideal	80	220/440	900
2	100	G.E.	80	220/440	600
1	60	G.E.	80	220/440	1200
2	50	G.E.	80	2200	600

SLIP RING MOTORS—CONSTANT DUTY—3-Ph., 60-Cy.

Qu	HP	Make	Type	Volts	RPM
1**	1200	C.W.	SR	2200	237
2**	1000	Al.Ch.	ANY	2200	234
1**	600	G.E.	MT-20	2200	360
2	500	G.E.	I-15-M	2200	450
1**	400	Al.Ch.	ANY	2300	514
3	400	G.E.	MT-413	2200	450
1	300	G.E.	I-15-M	2300	1200
1	300	Al.Ch.	ANY	2200	514
1	250	G.E.	MT-414	2200	300
1	200	G.E.	I-16-M	2200	585
1	150	G.E.	I-13-M	2200	1750
1***	125	Whse.	CW-870	2200	870
1	100	F.M.	H20C	440/220	900
1	75	G.E.	IM	440/220	695
1	75	Whse.	CW-7540	440/220	690
1	60	Whse.	CW	440/220	900
1	60	G.E.	MT-536	2270	1150
1	50	F.M.	SR	440/220	600
1	40	Al.Ch.	ANY	2200/440	435

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In our stock you will find manual and magnetic primary and secondary controls 10 to 3000 lbs., which we can furnish complete for any requirements.

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Qu	KW	Make	RPM	Volts DC	Volts AC
1	2400(3-U)	Al.Ch.	720	535	4800
1	2400(3-U)	Whse.	720	600	4800/2400
1	1000	G.E.	514	550	2300
2	500	C.W.	720	575	2300/440
1	500	C.W.	720	250/275	2300/440
1	250	Whse.	1200	125/250	2300
1	200	Whse.	1200	125/250	2300/440
1	200	Ridgway	900	275	2200
1	155	G.E.	720	250	2300/440
1	150	G.E.	1200	500	2300/440
1	100	Al.Ch.	1200	125/250	4000/2300
1	100	Delco	1200	125/250	440/220
1	100	C.W.	1200	125	440/220
1	100	Ridgway	1200	275	4000/2300
1	85	C.W.	1200	250	4000/2300
1	75	Star	1200	230	440/220
1	75	Whse.	900	75	2200
1	75	Al.Ch.	900	250	2300
1	50	Burke	1750	250	440/220
1	35	Whse.	1750	250	440/220
1	25	Ideal	1750	125	220
3	20	Al.Ch.	1200	250	440/220
1	15	Al.Ch.	1200	250	440/220
1	9	Whse.	1200	125	440/220 4
1	5	Reliance	1750	250	440/220

TRANSFORMERS—Power

Qu	Make	KVA	Type	Phase	Voltage
1	G.E.	2760	DH	3	7300/6900-240/480
3	Whse.	500	S	1	13800/7242Y/6900-4160/2400
4	G.E.	333	H	1	13200/1100-2200
3	Packard	250	A	1	13200-2300
3	G.E.	180	H	1	19900/9500-550/2200
3	G.E.	100	H	1	33000-2300
3	Whse.	100	SS	1	12075/10955-230/460
3	Whse.	100	Auto	1	4160/2400-2400/1385
2	Wagner	50	HE	1	13200/11880-575/287
3	Al.Ch.	50	OISC	1	22000-220
2	Uptegraff	37½	HD	1	2300-115/230
2	Kuhlman	13	Dry	1	480-240
45(new)	Al.Ch.	3	OISC	1	2400-120/240

DIRECT CURRENT MOTORS

Qu	HP	Make	Type	RPM
1***	3000	Whse.	Encl.(Rev.)	600
1***	2400	Whse.	Encl.(Rev.)	600
4***	1500	Whse.	Encl.(Rev.)	600
4***	1200	Whse.	Encl.(Rev.)	600
4***	800	Whse.	Encl.(Rev.)	600
1	350	G.E.	CD-109-A	1150
1	200/250	El.Dy.	No. 22	400/1200
1	250	G.E.	MPC	325/975
1***	200	G.E.	MPC	500/1200
1	200	Whse.	Mill	300/1200
1	180	G.E.	MPC	400
1*	150	C.W.	83-H	600
1***	125	Whse.	8K-190	600
2	125	Whse.	8K-184	575/850
1	100/125	Rel.	1995-F	800/1200
2	100	Rel.	1060-T	400/1200
1	90/160	G.E.	MPC	625/1125

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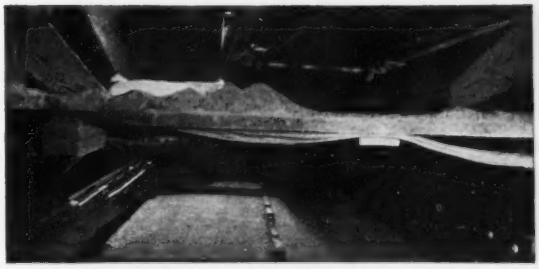
NOW... SCREEN FINE, MOIST MATERIALS Without Blinding!

ALLIS-CHALMERS THERMO-DECK Heating Unit

NO "TIME OUT" to clear fine or medium mesh screen cloth! You can screen fine, moist non-combustible materials *continuously* with new *Thermo-Deck* heating unit.

INCREASED CAPACITY! Heated screen cloth *remains* open, permitting more tonnage through the screen and better separation.

LOWER COSTS! Operating records show that heated screen cloth lasts up to three times as long when cloth does not have to be pounded free of blinding material. The *Thermo-Deck* heating unit can be easily applied in the field. Your nearby A-C representative can give you more details. Allis-Chalmers, Milwaukee 1, Wisconsin. A-3602



POWER ON — *Thermo-Deck* heating unit keeps screen cloth clear on screen handling pulverized limestone.

POWER OFF — Troublesome blinding results on same screen when *Thermo-Deck* heating unit is turned off.

See....

New *Thermo-Deck* Heating Unit in operation!

National Sand and Gravel and Crushed Stone Shows

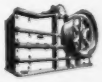
Stevens Hotel, Chicago
February 11th through 20th
ALLIS-CHALMERS BOOTHS 77-82

Thermo-Deck is an Allis-Chalmers trademark.

ALLIS-CHALMERS

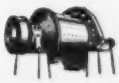
Sales Offices in Principal Cities in the U. S. A. Distributors Throughout the World.

Pulverator



Jaw Crushers

Gyratory Crushers

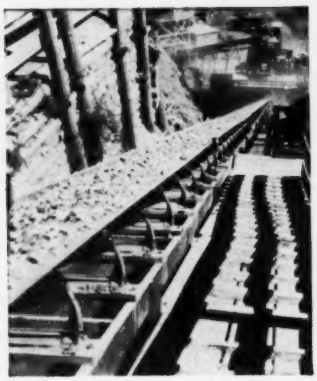


Grinding Mills

Vibrating Screens

Kilns, Coolers, Dryers

For heavy duty conveyors...



Belt Idlers manufactured by Continental Gin Company convey crushed stone from floor of quarry to screen house at this North Carolina Stone Company. Timken bearings in the idlers assure long idler life with minimum maintenance.

This dock unloading belt uses Timken bearing equipped idlers to handle 175 tons of crushed limestone per hour. Located in Newark, N. J., it's a Rex conveyor installation built by Chain Belt Company.

Linking a quarry to a processing plant three quarters of a mile away, this Barber-Greene conveyor system has a total of 8,556 Timken bearings in the idlers and moves 350 tons of crushed limestone per hour.

IT'S TIMKEN®... AND TIMKEN... AND TIMKEN AGAIN!

AND HERE ARE 6 BIG REASONS WHY:

1. **THOROUGHLY PROVED.** The Timken® bearing is the only tapered roller bearing proved by 15 years or more of service in heavy duty conveyor installations using the popular dead shaft construction.

2. **EXTRA CAPACITY.** Line contact between rollers and races gives Timken bearings high load capacity. And by using Timken bearing sizes that are mass produced for the automotive industry you get extra capacity bearings that actually cost *less* than the smaller sizes you'd normally use.

3. **LONG-LIFE LUBRICATION.** Not just lubricated for "life" but lubricated yearly or as conditions require to insure *long* life. Fresh lubricant ends gummy, sticky, jammed bearings.

4. **FRICTION MINIMIZED.** Timken bearings' true rolling motion and extremely smooth surface finish practically eliminate friction.

5. **LONGER ROLLER AND BELT LIFE.** Less sliding and scuffing between idlers and belt.

6. **MAINTENANCE REDUCED.** Long life and dependable performance of Timken tapered roller bearings cut maintenance to a minimum.

Remember "Timken" is not a bearing type. It is a trade-mark applying only to bearings made by The Timken Roller Bearing Company. Always use Timken bearings in your conveyors. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

Wherever the going's tough industry turns to

TIMKEN

TRADE MARK REG. U.S. PAT. OFF.

TAPERED ROLLER BEARINGS

Typical application of Timken bearings for conveyor idlers.

NOT JUST A BALL ○ NOT JUST A ROLLER ⬭ THE TIMKEN TAPERED ROLLER ⬭ BEARING TAKES RADIAL ⬭ AND THRUST →⬭← LOADS OR ANY COMBINATION →✳←